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SUSTAINABLE LEARNING ENVIRONMENTS
THE ISSUES AND POTENTIAL POLICY RESPONSES

A dissertation
submitted in partial fulfilment
of the requirements for the Degree of
Master of Property Studies

at
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by
Mark Stallmann

Lincoln University

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ABSTRACT & KEYWORDS

Abstract of a dissertation submitted in partial fulfilment of the requirements for the Degree of Master of Property Studies

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by

Mark Stallmann

Research on school knowledge of, and attitudes towards, sustainable learning environments was carried out to support policy development within the Ministry of Education. A recently developed tool is used by schools to measure the effectiveness of existing classrooms, or learning environments, against a 'modern learning environment' standard. One of the unresolved categories in the modern learning environments tool is that of 'sustainability'. It was proposed that the Ministry provide some form of environmental rating tool so schools can rate or measure their sustainability. Schools could then plan to increase their environmental rating through their normal property planning processes.

A review of sustainability related literature identified the need for clear and specific definition of sustainable concepts. To facilitate this research sustainable learning environments were defined as environments that are resource efficient, provide good indoor environmental quality, and protect the wider environment.

One of the important aspects of sustainable building that was reviewed was how to measure sustainability in buildings, and particularly in existing buildings. The costs and benefits of sustainable building provided indications that the hard benefits were generally positive and that the

soft benefits may be very positive, but further research is needed, particularly on soft benefits. The literature review then examined the costs and benefits of, and barriers to, sustainable learning environments in existing schools. As with new schools, further research is needed in this area.

A survey of school's knowledge and attitudes toward sustainability targeted principals as they are the key people in most schools.

From the survey, about 80% of respondents had at least some knowledge of sustainable building issues with over 90% acknowledging sustainability as 'important' or 'somewhat important'. While having little knowledge of environmental rating tools, there was a strong desire for a tool that could be used as part of the school property planning process and for teaching and learning. A majority of respondents also signalled their preference to search for and receive knowledge on sustainability through the internet.

Key Words: learning environments, sustainable, modern, environmental rating tool, resource efficiency.

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TABLE OF CONTENTS

ABSTRACT & KEYWORDS	I
ACKNOWLEDGEMENTS.....	III
TABLE OF CONTENTS	IV
LIST OF FIGURES	V
LIST OF TABLES.....	V
ACRONYMS	VI
1 AN INTRODUCTION TO SUSTAINABLE LEARNING ENVIRONMENTS..	1
1.1 General introduction	1
1.2 The research methodology and report structure	2
2 THE BACKGROUND TO CURRENT MINISTRY POLICY	6
2.1 How school property is managed and why	6
2.2 How school property is funded	8
2.3 Modern learning environments in existing schools	10
2.4 Sustainability in new schools	11
3 LITERATURE REVIEW	13
3.1 Introduction.....	13
3.2 What is sustainability	13
3.3 The costs and benefits of sustainable learning environments ..	25
3.4 SLE in existing schools	32
3.5 Conclusion	36
4 RESEARCH INTO KNOWLEDGE, ATTITUDES AND POLICY	38
4.1 Introduction.....	38
4.2 The survey	38
5 ANALYSIS.....	43
5.1 The Respondents.....	43
5.2 Knowledge of sustainable building issues.....	45
5.3 Sustainable Building Attitudes	49
5.4 SLE policy options.....	51
5.5 Information on sustainable learning environments	54
5.6 Conclusion and recommendations.....	57
6 REFERENCES	62
7 APPENDICES	65
7.1 Appendix 1 - Copy of SLE survey questionnaire.....	65
7.2 Appendix 2 - Copy of full results from SLE survey.....	73

LIST OF FIGURES

Figure 1: Policy wheel diagram (From MOE, 2010).	4
Figure 2: Shifts in 'green' design approaches	19
Figure 3: Green and sustainable models of assessment methods	24
Figure 4: Adoption curve for green buildings	35
Figure 6: Question 2 - Schools by type.....	44
Figure 7: Schools and respondents by sector	44
Figure 8: Question 3 – General knowledge of sustainable building.	45
Figure 9: Question 4 – Knowledge of resource efficiency.	46
Figure 10: Question 5 - Knowledge of the effects of IEQ.....	47
Figure 11: Question 6 - Relative knowledge of sustainability issues.	48
Figure 12: Question 7 – Knowledge of environmental rating tools.....	49
Figure 13: Question 10 - The importance of SLE issues.	50
Figure 14: Question 12 – Importance	51
Figure 15: Question 15 - Teaching and learning rating tool.	53
Figure 16: Question 16 – Where do you look for information?	54
Figure 17: Question 17 – How should we send information?	55
Figure 18: Question 18 – Further information.....	56

LIST OF TABLES

Table 1: Greening America's Schools.....	30
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ACRONYMS

SLE	Sustainable learning environments
MLE	Modern learning environments
10YPP	10-Year Property Plan
5YP	5-year Plan
MfE	Ministry for the Environment
NZGBC	New Zealand Green Building Council
IEQ	Indoor environmental quality
LCC	Life cycle cost
BREEAM	Building Research Establishment Environmental Assessment Method
LEED	Leadership in Energy and Environmental Design
UGBC	United States Green Building Council
GBCA	Green Building Council of Australia
NABERS	National Australian Building Energy Rating System

1 AN INTRODUCTION TO SUSTAINABLE LEARNING ENVIRONMENTS

1.1 General introduction

The purpose of this dissertation is to provide evidence for the development of policy on 'Sustainable Learning Environments' (SLE) for the Ministry of Education (the Ministry). Learning environments include all those spaces where teaching and learning take place. SLE may also be read as sustainable, green or high-performance schools.

Much work has been done by a variety of participants, including the Ministry, New Zealand Green Building Council (NZGBC) and Ministry for the Environment, to foster sustainable new schools and the focus has now turned to existing schools. However, the Ministry has no clear and agreed definition of sustainability or sustainable schools, nor is there any defined development pathway to SLE. Recent Ministry policies like Modern Learning Environments (MLE) and the introduction of environmental rating tools for existing buildings have created a platform from which to promote SLE in existing schools.

The need for an SLE policy has a number of drivers; international concerns for building related global warming, community environmental concerns, the need to conserve building related resources such as energy and water, the desire to create a safe and healthy internal environment for students and staff, and a desire to create an environment that is conducive to learning and teaching.

To enable this, an SLE policy needs to:

- define sustainable learning environments
- examine the costs and benefits of sustainable schools
- make clear, outcome driven, value for money, politically acceptable recommendations.

While this dissertation will not itself constitute a policy, it will attempt to place sustainability in context within the school system, provide an understanding of the major issues through a search of the literature, and test some theories and assumptions through a survey of schools.

The remainder of this section briefly outlines the proposed methodology and structure of this dissertation.

1.2 The research methodology and report structure

1.2.1 The aims, objectives and methodology

Aim

The aim of this research is to provide research-based information to Ministry policy makers who are in a position to create timely, relevant and operationally focused SLE policy.

Objectives

The objectives of this research are to:

- demonstrate the author's ability to "undertake a piece of sustained and rigorous investigative research" (Lincoln University, 2009, p. 1)
- review the current state of sustainable building policy in the Ministry
- identify and review relevant literature on sustainable building including:
 - what it is
 - what it costs
 - how to measure it
 - how to manage sustainability in existing buildings

- survey schools' knowledge of sustainable building, their attitude towards sustainability and their opinions on options for tools and information
- apply the knowledge from the above to recommend SLE policy directions to the Ministry.

Scope

There are many elements that might contribute to public policy on SLE, both strategic and operational. This research will include elements affecting both strategic and operational policy including:

- current thinking on 'greening' existing buildings
- what others are doing
- school views.

This research will not:

- discuss the issue of, or links to, global warming or CO₂ (while acknowledging those concerns as a broad basis for much of the impetus for sustainability)
- consider specific sustainable building technologies and systems or the 'how to' of sustainable building.

Methodology

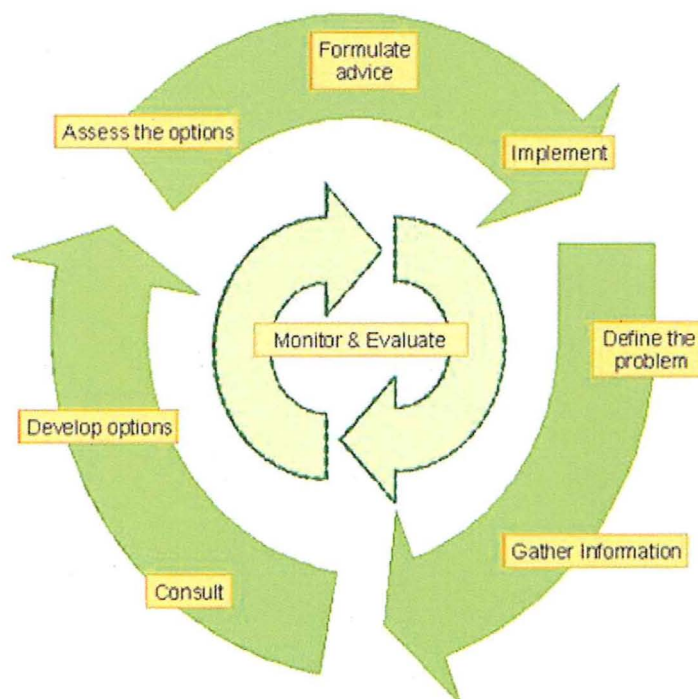
This dissertation essentially follows the methodology proposed and discussed in Lincoln University's *Student Guide to Dissertations* (2009).

That includes:

1. establish the aim, objectives and methodology
2. complete a literature review
3. conduct empirical analysis
4. write conclusions and recommendations.

This methodology is similar to policy writing. Policy requires planning and problem definition, gathering information, exploring options and writing recommendations. The Ministry's policy wheel diagram is one of many ways of demonstrating the policy process. This research aims to provide input into the SLE policy wheel through the gathering of information and the development and assessment of options. The formulation of advice and implementation of policy may fall to others.

Figure 1: Policy wheel diagram (From MOE, 2010).



1.2.2 Literature review

Sustainable building is a wide-ranging and ever-expanding topic. Therefore, the literature review will target a number of specific topics that are considered of most importance to SLE. Those topics have been chosen in an attempt to answer the questions 'what is a SLE', 'what are the costs and benefits in pursuing SLE' and 'how might we implement SLE in existing schools'?

1.2.3 Research

It is intended to survey schools to obtain a view of their knowledge and attitudes towards sustainability. The results of this may affect the design of any policy implementation and signal the desire or lack thereof for schools to be involved in sustainable building. The survey also intends to ask schools their opinion of some proposed policy delivery methods. Further questions may be included to determine the best avenues for delivery of sustainable programmes or information.

2 THE BACKGROUND TO CURRENT MINISTRY POLICY

2.1 How school property is managed and why

New Zealand's Ministry of Education owns the second largest real estate portfolio in New Zealand (book value about NZ\$12 billion) behind that of Housing New Zealand.

Unlike Housing New Zealand and most departments and Ministries, the Ministry of Education does not directly manage the properties it owns. Most school property development, property maintenance and other property management functions are carried out by each school's Board of Trustees (the board or boards) as agents of the Ministry. While many organisations use agents who act directly on their instruction, boards can only be directed in specific ways using the appropriate legislative tools.

Until 1989 the "Department of Education... was the policy adviser, implementer, funder, provider, regulator and manager of last resort" (Ministry of Education [MOE], 1993, p. 8). Education boards managed primary schools on behalf of the Department and elected boards governed secondary schools, although they were "mostly funded and regulated from the centre" (MOE, 1993, p. 8).

The Lange government's Tomorrows Schools reforms "led to an upheaval of reform in 1989 that transformed the landscape of education administration" (MOE, 1993, p. 8). While Tomorrows Schools was a major change, Butterworth and Butterworth suggested it was also a return to the past, quoting Charles Bowen who stated in 1877 "the Government is perfectly satisfied that the general administration of the schools must be left in the hands of Local Boards" (1998, p. 9).

In terms of property management, the reforms of 1989 included transferring the administration of property to boards. This change was based on the view that "devolution of authority with local decision-

making results in a more effective expenditure, a fairer allocation of resources, and an improved educational environment matching the needs of pupils” (MOE, 1993, p. 55).

In practice, the Ministry remains the owner of most state school land and buildings while management is split between the Ministry and boards. The details of who is responsible for what is described in each school’s Property Occupancy Document (POD). The Ministry states

Each board of trustees, in partnership with the Ministry of Education, shares responsibility for the management of school property. This relationship is recorded in the Property Occupancy Document (POD) which applies to all state schools. It is essentially a notification to schools recording who is responsible for what (MOE, *Property*, 2010).

While the Ministry is responsible for ensuring the appropriate use of public funding allocated for school property, boards have a responsibility to:

- ensure there is alignment between the school’s vision and property plan
- keep up to date with current Ministry policies and requirements
- develop a 10-Year Property Plan (10YPP) to provide the right quantity and quality of school property to achieve the best physical environment for learning
- engage project managers to manage building projects at their schools
- oversee the day-to-day management of school property to ensure it is in good order and repair (MOE, *Property*, 2010).

The POD sets out the mandatory property management requirements for boards and the Ministry's Property Handbook advises boards how they can meet those requirements, although much of the day-to-day work falls to the school principals.

The Ministry has the authority to make changes to the POD and Handbook through section 70 of the Education Act 1989. Section 70 allows the Secretary for Education to "specify terms and conditions applying generally to land and buildings occupied by boards".

It is important to understand this system as attempts to successfully introduce new policy rely to a great extent on the ability, knowledge and desire of boards and principals. For example, the Ministry requires schools with their own drinking-water supplies to meet the current drinking-water standard (Drinking-water Standard of New Zealand 2005). Despite the effort to create incentives and provide advice and information to trigger change, only 17% of New Zealand schools met any drinking-water standard in 2007/08 (Ministry of Health, 2008). The Ministry has little leverage with boards on issues such as this. While financial leverage is available, reducing a school's already limited funding may be somewhat self-defeating.

2.2 How school property is funded

Where SLE sits within school funding priorities will affect how well it is promoted and managed. School funding is relevant to creating sustainable schools because it is through the operating and capital funding mechanisms that school spending can be prioritised. For example, a recent policy change has mandated that health and safety issues should be the highest priority for school spending. If the Ministry made the drinking-water standards a health and safety priority, schools would have to meet the standard before they could spend money on other capital projects.

Operational funding

According to the Ministry of Education

Operational funding is paid by the Ministry of Education to a board of trustees to run the school. Operational funding does not include funding for the salaries of entitlement teachers, property, or large capital items. These are paid for separately (MOE, *Property*, 2010).

While schools receive operational funding as a single sum (paid in instalments) it is composed of a number of separate components. One of these components is Heat, Light and Water (HLW). HLW pays for a schools energy costs based on an annual calculation of the rolling average of actual cost over the last three years. This is not currently sustainable because it acts as a disincentive to energy conservation and whole-of-life-cost purchasing.

Capital funding

Schools receive capital funding for property developments. Payment of this funding is linked to the provision of a 10-Year Property Plan (10YPP) by each school. Schools must create a 10YPP. The process is detailed and involves reconciling school needs and wants against the school charter, the upgrade and refurbishment needs of the school and Ministry funding priorities.

Schools must employ a professional project manager to manage the 10YPP process. The project manager's role includes condition assessment, communication, and writing the 10YPP. Once this has been signed off by the board and the Ministry, the board receives five years worth of capital funding through a signed 5-Year Agreement (5YA) with the Ministry.

New policy that creates school property spending priorities comes into force on 1 July 2010. Under this policy, schools must allocate their spending in their 10YPP according to set priorities. Those priorities are:

Category One - Health and safety matters

Category Two - Essential infrastructure projects (needed to ensure the integrity of building structure or services)

Category Three - Modernising their learning environment to the 'core' standard level in accordance with the Modern Learning Environments (MLE) Tool (MOE, 5YA..., 2010).

2.3 Modern learning environments in existing schools

MLE policy is part of the Ministry's drive to focus the capital spending of existing schools on classrooms, rather than sports or administration facilities.

The MLE tool is an attempt to "support schools to meet the 'core' standard of a modern learning environment' by 2020. The core MLE standard includes those property areas considered to have the most significant positive influence on education outcomes" (MOE, 5YA..., 2010).

Schools that have met their Category One and Two property needs will be expected to carry out a MLE assessment and use the results to create their 10YPP. The MLE tool assesses teaching spaces on their fitness for purpose under the following categories:

1. General learning spaces
2. Community of learners – other supporting spaces for teachers and students
3. Furniture
4. Environmental design
5. Architectural connections

6. Community context.

Section 4, Environmental design has two sub-categories:

- 4a) High quality internal environment in all learning spaces (Heating/Insulation, Lighting, Ventilation, Acoustics).
- 4b) Sustainable design.

It is in this section that Sustainable Learning Environments policy has the potential to promote greater sustainability through school property.

2.4 Sustainability in new schools

The current MLE policy is aimed at existing schools. New schools are considered separately using similar criteria during the design process. Any SLE policy will also be aimed at existing schools as sustainability in new schools is addressed separately through the use of the New Zealand Green Building Council (NZGBC) Green Star Education environmental rating tool.

Sustainable school development began after a number of 'dry' years in the electricity sector and the resulting focus on energy efficiency. A 10% weighting was applied to new school construction budgets and targeted at designing and building schools that were more energy efficient than typical schools. This was provided to project teams on the basis of a separate energy efficiency report describing how and where the funds were to be spent and the payback period for each item. Schools, boards and their communities began to drive the spending of this money on energy efficiency and wider sustainable building ideas such as water efficiency, solar water heating and even on-site energy generation.

In 2006 the Ministry began to consider how it might ensure that the government was receiving value-for-money from this spending. At the same time the Cabinet Policy Committee directed public service departments to speed up the implementation of sustainable design for

buildings (2006). The building industry became involved and this led to the formation of the NZGBC whose purpose is to accelerate the development and adoption of market-based green (sustainable) building practices through the use of environmental rating tools.

This eventually included the Green Star Education environmental rating tool for new schools. Development of this tool was funded by the Ministry and it is now used to design Green Star schools to a 5-Star or New Zealand excellence level. These tools are intended to give independent verification that the 10% green construction funding is used effectively.

What is still missing from the Green Star rating tool suite is a tool that rates existing buildings. Not only is such a tool needed to compare the operation of new buildings against their designed performance, but it would also be used to rate and benchmark existing buildings. It has been suggested that such a tool could be a useful starting point for the sustainable redevelopment or refurbishment of existing schools and as part of a SLE policy for existing schools.

The NZGBC is currently working towards a Green Star In-use tool that would measure the actual performance of a building in use. As with the Green Star Education tool it may be that an In-use Education tool can be created.

3 LITERATURE REVIEW

3.1 Introduction

There is a huge amount of research, writing and literature on the subject of sustainability. The scope of the subject has made it necessary to concentrate on those few topics that may most affect Ministry policy on SLE.

How to define SLE is important and began with an examination of the literature of sustainability. The review evaluated and compared current definitions of sustainability, sustainable building and sustainable schools with the intent of defining SLE for both the Ministry and the wider school sector (interest groups such as the School Trustees Association, teacher unions, Enviroschools etc).

Having considered sustainability, the review examined some ideas on how best to measure sustainable building, comparing the incremental 'green building' approach with a fully sustainable approach.

The literature available on the costs and benefits of sustainable schools was then reviewed along with literature relating specifically to existing schools. This included the costs and benefits of SLE in existing schools, and barriers to SLE.

3.2 What is sustainability

Possibly the most often quoted definition of sustainability is that of the World Commission on Environment and Development of 1987. Their report, known as the Brundtland Report, defined sustainable development as

development that meets the needs of the present without compromising the ability of future generations to meet their own needs (UN, 1987, p. 54).

This definition created a wider view of sustainability than had previously been the case. The Sustainable Development Gateway (2010) noted that the Brundtland definition changed the idea of sustainability from mainly an ecological paradigm to one that also included economic and social concerns and also

requires an understanding that inaction has consequences and that we must find innovative ways to change institutional structures and influence individual behaviour. It is about taking action, changing policy and practice at all levels, from the individual to the international (*Definitions*, 2010, para. 3).

While the Brundtland definition is often seen as overarching it does not serve all masters. In a survey of definitions, the University of Reading included the following:

- Pearce, Makandia and Barbier, (1989)

Sustainable development involves devising a social and economic system, which ensures that these goals are sustained, i.e. that real incomes rise, that educational standards increase, that the health of the nation improves, that the general quality of life is advanced.

- Holdgate, (1993)

Realising resource potential... implies respecting limits to the development process, even though those limits are adjustable by technology.

- Pearce, (1993)

The development of a society where the costs of development are not transferred to future generations (as cited in *Definitions*, University of Reading, 2010).

While these are all noble definitions Daly (1991) argues that

Lack of a precise definition of the term “sustainable development” is not all bad. It has allowed a considerable consensus to evolve in support of the idea that it is both morally and economically wrong to treat the world as a business in liquidation (as cited in *Definitions*, University of Reading, 2010).

O’Riorden commented on the difficulty of defining sustainability, describing its definition as an “Exploration into a tangled conceptual jungle where watchful eyes lurk at every bend” and Spedding commented that perhaps this was the reason for “The remarkable number of books, chapters and papers, that even use ‘sustainable’ or ‘sustainability’ in their title but do not define either term” (as cited in *Definitions*, University of Reading, 2010).

It may be better for researchers and organisations to attempt to define sustainability on their terms and risk ‘watchful eyes’ than not define a key concept of their research. The New Zealand Ministry for the Environment (MfE), for example, offers this commentary:

Curwell and Cooper (1998) identify three other common ways to describe sustainable development: ‘environment’ refers to the preservation of local and global ecosystems to sustain all life; ‘public participation’ acknowledges the need for all people to participate in positive change; and ‘equity’ refers to a fair sharing of global resources for both human and non-human life. In essence, therefore, a sustainable built environment could be described as one which takes into account the needs of future generations, ecological health, public participation and equity (MfE, 2009, p. 3).

Birkeland notes that there are over 400 definitions of sustainability but that most share similar concerns and consistently reference the same basic ideas of environment and equity. Birkeland agrees that such

consistency is important in creating a shared understanding of sustainability issues. Birkeland argues that most definitions are compatible “when people fully appreciate how human survival and wellbeing depend on the ecological integrity of the planet” (2008, p viii).

The Government of Western Australia’s Department of the Premier and Cabinet has a definition based on Brundtland: “meeting the needs of current and future generations through an integration of environmental protection, social advancement, and economic prosperity” (2010). As with Birkeland, the Government of Western Australia acknowledges the complexity and number of concepts embraced by sustainability through its concerns with the integration of those factors.

Any attempt to introduce high-performance or sustainable concepts to schools needs to do so in a simple, easily understandable way. It should not, however, lose sight of the complexity, system orientation and social and economic benefits implied by the term ‘sustainability’.

3.2.1 The sustainable development of buildings

It is acknowledged that the literature on sustainable development and sustainability is large (Birkeland, 2009; MfE, 2010) and we can see that the resulting definitions can be complex. In terms of the sustainable development of buildings, Gaia Research has created a ‘plain English’ sustainable building definition for Scottish schools that encompasses the breadth and depth of many others, while appealing more because of its pragmatic perspective

Sustainable building design is applied good sense – an aspiration to build to the highest quality and functional standard, with maximum environmental and social benefit and with cost assessments that reflect the whole building life cycle such that investment can be properly maintained (2004, p. 8).

One of the benefits of Gaia Research's answer to the question 'what is sustainable building design' is that it focuses on intended outcomes. They describe their outcomes as minimising any adverse social, environmental and economic impacts and maximising positive social and economic impacts.

There are a number of sustainable design philosophies or methodologies that help define sustainable buildings, for example ecological design, environmental design, green design, sustainable design and ecologically sustainable design. While design is one part of the development process, the use of the term sustainable in the context of either building design or development signifies, according to Kibert (2005) a process that embraces the concept of triple bottom-line reporting of effects. Those effects are environmental, social and economic impacts. This in effect means considering the wider impact of a development as opposed to having a narrow building technology focus.

Following Kibert, MfE also explored a number of built environment concepts including eco-efficiency, cradle-to-cradle development and restorative and regenerative development. Their key findings, important in the context of policy for schools, include that the "built environment will still be in place in 50 years' time" and, cited Story et al (2004), noting that "the development of a sustainable built environment will therefore largely rely on retrofitting existing infrastructure and buildings" (2009, p. vi).

MfE defined eco-efficient development as an improvement on current practices, but one that still creates negative environmental impacts. In other words, not good, just less bad (possibly attributable to William McDonough at a meeting in 2009). According to Kibert eco-efficiency "includes environmental impacts and costs as a factor in calculating business efficiency" (2008, p. 39). Despite some concerns over greenwash, Kibert argues that eco-efficiency is at least a sign that the

business community is beginning to take sustainability seriously (2008). Others have a different view, with Birkeland suggesting that eco-efficiency business models are more properly equated with increasing consumption, albeit sustainable consumption.

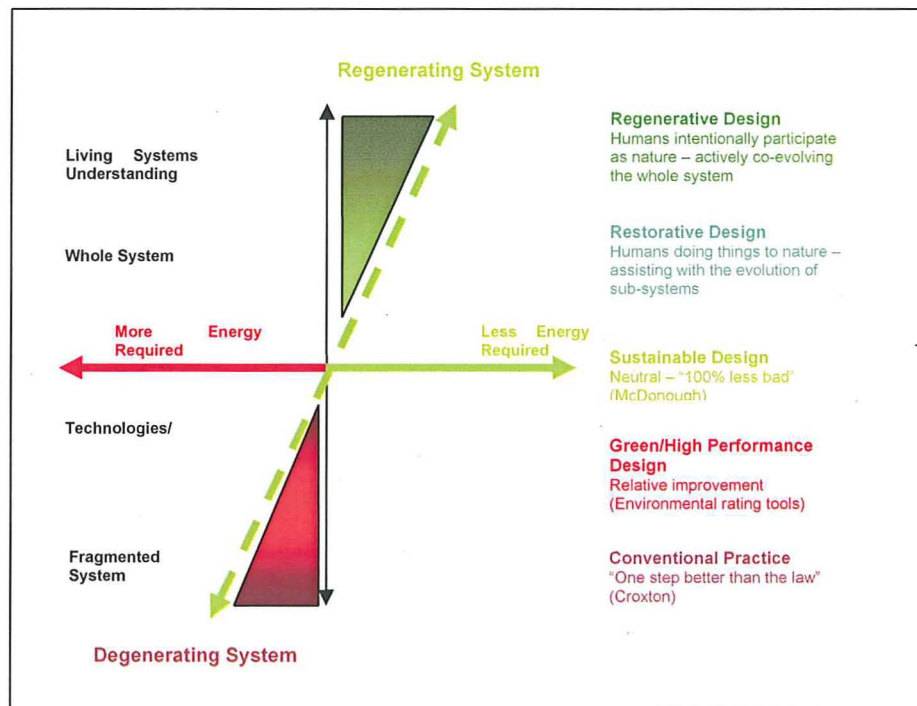
MfE suggest a better way might be regenerative, restorative and cradle-to-cradle development because “they aim for net positive environmental outcomes. This is a new way of thinking that sees development as a way to improve the health of ecosystems” (2009, p. vii).

MfE promote the key benefits of regenerative, restorative and cradle-to-cradle development concepts as:

- creating and strengthening relationships and communities by focusing on the process of engagement as well as the outcomes
- creating stronger, healthier, more equitable communities
- greater understanding of local traditions and indigenous knowledge... particularly significant in New Zealand given the importance of tangata whenua traditions and knowledge of place
- an emphasis on the long term consequences of material and energy choice selection (2010, p, vii).

Kibert uses a diagram created by Bill Reed of the Integrative Design Collaborative to describe the “ongoing shift in design from conventional approaches that barely meet building codes to regenerative design that actively engages humans in a synergistic relationship with natural systems” (2008, p. 123). The diagram (seen below in Fig. 2) places us firmly at the beginning of his suggested pathway to regenerating systems.

Figure 2: Shifts in 'green' design approaches (From Kibert, 2008, p. 123).



According to Bill Reed (as cited in Kibert, 2008), building development in first-world and some developing countries probably sits somewhere between conventional practice and Green or High Performance design. In sustainable design and development terms, this places the Ministry not far behind the leading edge in New Zealand building design and construction for its new buildings.

3.2.2 The sustainable development of school buildings

It might seem an exercise in semantics to further attempt to define 'sustainable schools', having already considered the meaning of 'sustainability', and 'sustainable buildings' but the point is that a major part of policy is being able to implement (or sell) the policy that has been written. Any policy that will need Ministerial approval has to be able to sell itself within one or two pages. Therefore, how the topic is named and defined may affect its support from the Minister and will affect how it can or will be promoted and sold to schools. Gaia Research's 'applied good

sense' may be a better starting place for this purpose than definitions that focus on intergenerational equity.

In America, one approach is to use the term 'high performance school' as a synonym for sustainable schools. The Collaborative for High Performance Schools (CHPS) defines a high performance school as one that is:

- Healthy
- Comfortable
- Energy Efficient
- Material Efficient
- Easy to Maintain and Operate
- Commissioned
- Environmentally Responsive Site
- A Building That Teaches
- Safe and Secure
- Community Resource
- Stimulating Architecture
- Adaptable to Changing Needs

(CHPS, 2010).

Eley describes high-performance schools as schools "designed to achieve a combination of goals: to be safe and healthy settings for students, teachers, and staff; to protect the environment; and to be economical to build and operate" (2006, p. 331).

The National Academy of Sciences in its *Review and Assessment of the Health and Productivity Benefits of Green Schools* (2006) defines sustainable schools as schools that:

- cost less to operate than conventional schools
- are designed to enhance the teaching and learning environment
- conserve resources such as energy and water.

The high performance school nomenclature may be confused with other 'high performing' initiatives in New Zealand, high performance being a goal in a number of teaching and learning programmes. For this reason, it

may be better to call the concept of high performance or sustainable schools 'Sustainable Learning Environments'.

A suggested definition of SLE is environments designed using applied good sense to:

- minimise resource use
- improve the comfort, health, and safety of their occupants, and
- limit their detrimental effects on the environment.

3.2.3 How to measure a sustainable building

Environmental rating tools

While concepts of sustainability and sustainable development were debated over decades, those involved with property development began to realise the size and impact of building development on material use, energy and waste. The United Nations Environment Programme calculated that building construction and operation uses 40% of the world's energy and material resources and building construction and demolition cause 40 % of the world's greenhouse gas emissions (UNDESA, 2003).

Cole notes that "the building industry will be increasingly scrutinized and required to develop approaches and practices that address immediate environmental concerns and adhere to the emerging principles and dictates of sustainability" (1999, p. 1).

Worldwide, the building industry (from developers and designers to builders and demolition firms) appears to have settled on the concept of environmental rating tools as the way forward in the drive to create 'green' or sustainable buildings or to create 'sustainable developments'. Cole (1999) suggested their most significant contribution at that time was to promote of a culture of assessing the sustainability of buildings across a range of criteria, although it might be argued that they remain focused

on resources and costs rather than the ethical and community considerations of sustainability.

The British BREEAM environmental rating tool has been around longer than most, and led to the US Green Building Council (USGBC) LEED tool. The Green Building Council of Australia (GBCA) then developed Green Star based on LEED. This was followed by the NZGBC's Green Star tools.

According to the GBCA Green Star was developed in order to:

- Establish a common language;
- Set a standard of measurement for green buildings;
- Promote integrated, whole-building design;
- Recognise environmental leadership;
- Identify building life-cycle impacts; and
- Raise awareness of green building benefits" (*What is Green Star*, 2009).

The tools are used to assess the environmental impacts of new buildings at the design and/or built stage. In the NZGBC suite of tools there are eight sustainability categories:

- Management
- Indoor Environment Quality
- Energy
- Transport
- Water
- Materials
- Land Use and Ecology
- Emissions.

Each category is divided in to a number of credits. Each credit is linked to design, materials or actions that may have a positive effect on environmental performance. Each credit is eligible to receive a number of points which are then calculated, weighted and a 'star rating' is then given if a minimum number of points are accumulated.

Rating stars are awarded depending on the points achieved, and include:

4-Star Best Practice

5-Star New Zealand Excellence

6-Star World Leadership.

Projects scoring less than 4-Star are ineligible for a rating.

Green building organisations and tools appear to have captured mainstream support with rating systems now popular in many countries, but at this time most of these tools relate to new buildings. Of much interest to the property industry is the relative performance of existing buildings and most of the 'green' building organisations are now focusing on developing rating tools for existing buildings.

Challenges to green building tools

While the current crop of rating tools appear to have captured the building market some see them as merely measuring less harm relative to current practice and falling short of providing guidance to full sustainability.

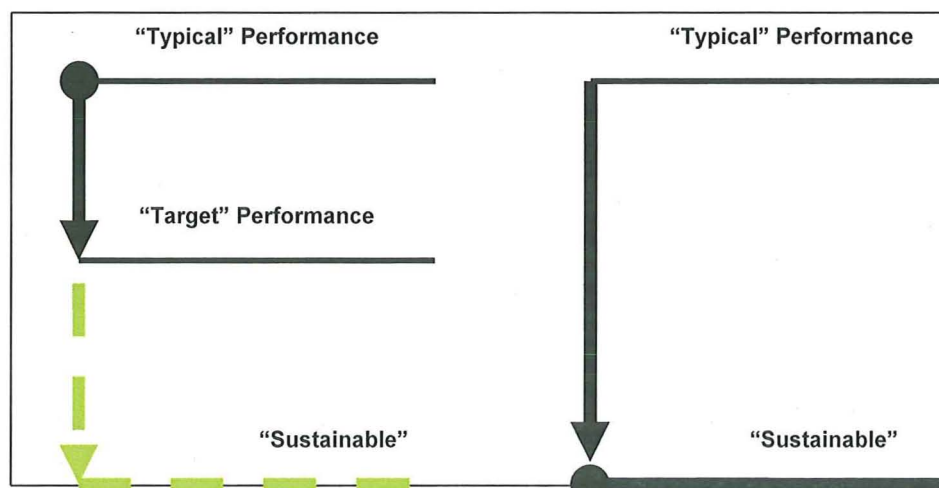
Cole (1999) identifies three distinct roles for rating tools:

- provide a common and verifiable set of criteria and targets so that environmental efforts can be recognised
- provide a basis for making informed design decisions, and
- provide an objective assessment of a building's impact on the environment.

Cole distinguishes between 'green' and 'sustainable' rating tool concepts and in doing so addresses a strong objection to current rating tool systems. Cole describes 'green' tools as measuring "buildings relative to current typical practice" and offering designers ways of improving on current practice while they "only implicitly acknowledge sustainability as a goal" (1999, p.4). Cole also suggests, and others agree (Birkeland, 2008), that the main objective of these tools is to stimulate market demand for green buildings with a secondary objective of gaining credit with environmentalists. However, those developing the current generation of tools might argue that they are a good start and that if the market is not involved much less good can be done in environmental terms.

Cole's alternative to the green rating tool is the 'sustainable' rating tool. Cole suggests that sustainability should be used as the basis for the development of environmental rating tools. Rather than aiming to create 'green' buildings that are relatively better than existing buildings, the sustainable assessment would be aimed at creating 'real' sustainable buildings. That is, how much progress has been made towards a definable sustainable condition rather than how far we have distanced ourselves from unsustainable buildings.

Figure 3: Green and sustainable models of assessment methods (From Coles, 1999, p. 4).



A practical example of sustainable assessment put forward by a Chapter of the USGBC, current owner of the LEED 'green' building assessment tool, is that every site should have an energy and water budget based on the amount of solar energy available to it and the amount of rain water falling on the site in any one year.

While many would like to see a paradigm shift to 'sustainable' environmental rating tools as described by Cole (1999), even the relative assessment approach is still new to the market. Proposing a shift to 'sustainable' assessment may be a paradigm shift too far at this time, although Birkeland (2008) sees another paradigm shift as necessary because current best practice is not good enough.

One factor that is creating more development of rating tools is that the current examples mostly rate new design or newly built buildings. The next logical step is to rate those buildings in operation and to then compare the actual performance with the designed performance. This feedback loop is needed to ensure that the features designed work as designed and that successful features can be incorporated into future designs.

It seems clear that the current crop of green tools is market led and that sustainable alternatives may one day become the norm. For practical reasons, including cost and lack of alternatives, most organisations will remain in the current paradigm. The Ministry is likely to be one of those organisations. It is to be seen whether schools will accept the concept of environmental rating tools to help drive their sustainable development.

3.3 The costs and benefits of sustainable learning environments

Eley (2006) has suggested the benefits of SLE might include improved health and comfort and academic performance, protection of the environment and cost savings.

Kats, in a number of related reports (2003, 2006), lists SLE benefits such as lower energy, waste disposal and water costs, lower environmental and emissions costs, lower operations and maintenance costs, and cost benefits from increased productivity and health.

Costs are also relevant and might include higher initial building costs, the cost of greater building complexity, additional training for property staff, greater initial and ongoing commissioning costs, and the costs of replacing 'expensive' green components.

3.3.1 Hard and soft costs and benefits

Benefits and costs are often broken down into hard and soft.

Kibert defines hard and soft costs as:

Hard costs are those that are easily documented because the owner receives periodic billing for them – for example, electricity, natural gas, water, waste-water, and solid waste.

Soft costs are those that are less easy to document and for which assumptions must be made for their quantification. Examples of soft costs are savings on maintenance costs, employee comfort/health/productivity attributable to a building, improved IEQ and reduced emissions (2005, p. 331).

Kibert suggests that hard costs should dominate any analysis of sustainable buildings costs when they are going to be reviewed by financial decision makers. He also suggests that soft costs should be employed where factors other than finance will be important (2005).

Treasury, in agreement with Kibert, suggests that when assessing green accommodation proposals

It is important to provide "hard" baseline information in the first instance, and then present the softer benefits as additional. Sometimes all that is possible or appropriate is for

the proposal to note in a qualitative way that these additional benefits are likely to arise (2007, p. 3).

In terms of hard cost savings over the life of a building, Kibert suggests that the following points need to be considered

1. The primary life-cycle savings for a high-performance building will be a result of superior energy performance.
2. Life-cycle saving can also be easily demonstrated for water and wastewater conservation measures because these utilities, like energy, are well known.
3. Savings due to good IEQ can potentially exceed all other savings [e.g. through productivity].
4. Savings due to building materials factors are very difficult to demonstrate. [Kibert noted that the cost of compressed wheatboard, a 'green' ply alternative, was 10 times that of ply] (2008, p. 332).

In terms of soft benefits, Treasury's advice is that

Some environmental and social benefits (e.g. productivity improvements) are less conducive to quantification. Our suggested approach for these "softer" benefits is to:

- Quantify where possible
- Draw on available evidence
- Set out assumptions
- Undertake sensitivity analysis where appropriate (2007, p. 3).

In discussing soft benefits, Kats says that "There is now a very large body of research... which demonstrates significant and causal correlation between improvements in building comfort and control measures, and

worker health and productivity" (2003, p. v). Kats also says that "the data supports a broad range of calculated benefits – in contrast to the more precisely measurable energy, water, and waste savings" (2003, p. v).

3.3.2 Quantifying financial costs and benefits

In terms of school buildings, Kats noted that a "rapidly growing trend is to design schools with the specific intent of providing healthy, comfortable and productive learning environments" and that the additional costs incurred in designing and building these schools has been "a major obstacle at a time of limited school budgets" (2006, p. 2).

Kats calculated that a green premium (the initial extra cost to build a green building compared to a conventional building in the US) is 1% to 2%. He looked at 30 schools and found the premium varying from 0% to 6.3%.

The Australian Green Building Council's (AGBC) 2006 report *'The Dollars and Sense of Green Buildings'* noted that "the Australian property industry should not expect the cost to build green to exceed a 3% premium" (p. 5). This was based on the whole property industry and was not school specific.

A recent Value Case Study commissioned by the Ministry from eCubed Building Workshop Ltd (eCubed) to identify the costs and benefits of achieving Green Star 5-Star accreditation for new primary and secondary school buildings found that the average cost premium was between 1.8% and 4.1% (*Ministry of Education's Green Star Education Value Case*, 2010). From this, it would seem that the Ministry's current Green Star premium of 10% of the construction budget is more than generous. The size of the project does have an impact on this however, with eCubed recommending a 'Green Star Lite' solution for schools with a construction budget of \$10 million or less.

Kats (2006, p. 2) reported the net financial benefits of Green School design, inclusive of hard and soft costs, to be \$71USD per square foot. Kats 2006 table of financial benefits has been converted to \$NZ per square metre in August 2009 at an exchange rate of \$1USD = \$1.41836 NZD.

Table 1: Greening America's Schools (From Kats, 2006, p.2).

Financial Benefits of Green Schools (NZ\$/m2)	
Energy	\$ 146
Emissions	\$ 16
Water and wastewater	\$ 16
Increased earnings (through higher achievement)	\$ 793
Teacher retention	\$ 49
Employment impact	\$ 81
Asthma reduction	\$ 65
Cold and flu reduction	\$ 32
Total	\$ 1,197
Cost of High Performance Schools	\$ 49
Net Financial Benefits	\$ 1,149

It is doubtful that these figures, especially for soft benefits, could be used in New Zealand without substantial verification. The hard benefits are impressive on their own, with financial benefits of \$178NZD per square metre reported. This was based on findings that green schools use an average of 33% less energy than conventionally designed schools. The reasons given for this include more efficient lighting, greater use of day-lighting and sensors, more efficient heating and cooling systems and better insulated walls and roofs. School building typology is not discussed in the Kats report but in comparison to New Zealand schools, US schools appear to be somewhat larger and with commercial scale heating and cooling engineered to match. They tend to have fewer but larger buildings

on site. A New Zealand-based study similar to Kats may be useful once sufficient Green Star schools have been built in New Zealand.

3.3.3 Quantifying the soft benefits of green schools

In discussing soft benefits, Kats said that "There is now a very large body of research... which demonstrates significant and causal correlation between improvements in building comfort and control measures, and worker health and productivity" (2003, p.86). For example, better indoor air quality and control over work environment, including lighting levels, air flow, humidity, and temperature. Kats contrasts the soft benefit areas described with more easily measurable areas such as energy and water use.

Kats noted in 2006 that the use of school-specific studies would limit the data available to understand and quantify the benefits of sustainable schools and suggests that

The tasks done by "knowledge workers" (including most non-factory white collar workers) - such as reading comprehension, synthesis of information, writing, calculations, and communications - are very similar to the work students do. Large-scale studies correlating green or high performance features with increased productivity and performance in many non-academic institutions are therefore relevant to schools (2006, p.9).

The American National Academy of Sciences (the National Academy) report *Green Schools: Attributes for Health and Learning* (2006) casts considerable doubts over the soft benefits claimed by Kats. The National Academy committee was asked to "review, assess, and synthesize the results of available studies on green schools and determine the theoretical and methodological basis for the effects of green schools on student learning and teacher productivity" (p. 1).

The National Academy report looked at research on the following topics in relation to their effect on health and learning outcomes:

- Moisture management
- Indoor air quality
- Lighting
- Acoustics
- Building characteristics and the spread of infectious disease
- Overall building condition and student achievement.

The National Academy found that the studies reviewed provided the following evidence of association between the topics and effects on staff and students:

<u>Topic</u>	<u>Evidence of Effect</u>
Lighting	Some
Moisture Management	Sufficient
Acoustics	Sufficient
Air Quality	Good

However the National Academy also noted that these studies lacked the rigour that might be expected of a well-designed and evidence based programme of studies into the benefits of green schools on teaching and learning (2006). The National Academy looked only at the literature and did not try and draw financial benefit conclusions from it. Had they done so, it is doubtful that they would have supported Kats less cautious benefits approach.

3.4 SLE in existing schools

3.4.1 Costs

Nowhere in the information presented by Kats or the National Academy is there any consideration of the cost of 'greening' existing schools, or creating SLE in existing schools. One of the problems with gathering relevant data in New Zealand and overseas is that tools that might be used to compare the performance of existing buildings, the cost of upgrading those buildings to some known standard and the benefits thereof, do not yet exist or have only recently been introduced

While some retrofit cost/benefits information is available it tends to be from the refit of existing multi-storey office buildings. One such report from Leonardo Academy concluded that the "overall cost of LEED-EB [existing building] implementation and certification had an average cost of \$37.56 per square meter (\$1USD = \$1.41836 NZD as at April 2010) ('The Economics of LEED', 2008), but did not make any conclusions about the financial benefits.

3.4.2 Benefits

It may be that for existing buildings, the hard and soft benefits of SLE are similar in type to those of new schools but smaller in size due to the ability to minimise costs and maximise benefits in a new build.

However, in terms of market size, the existing school building market is a far more important target for improved environmental performance. Birkeland (2008) noted that as new construction is only about two per cent of the total building stock, new green buildings have little impact on the rate of resource consumption from development. Therefore, eco-retrofitting existing building stock is an imperative. Birkeland (2008) uses the term 'eco-retrofitting' to mean "modifying buildings and/or urban areas to improve overall human and environmental health, and to reduce

resource depletion, degradation and pollution" (p. 23), arguing that simple energy efficiency measures will not be enough to meet her goals. Birkeland suggests 'integrated retro-fitting' as the way forward, meaning planning "whole building retrofits" combining "several systems to reduce usage synergistically" (p. 28).

Using a wider environmental design view, schools could better maximise their capital spending and the benefits of sustainable learning environments. As Birkeland says, this implies an integrated design approach rather than just adding on energy saving equipment (2008). This is a more complex approach and suggests schools may require some assistance to overcome barriers, real and perceived, if they are to maximise the sustainable benefits of their spending.

3.4.3 Barriers to SLE in schools

While the recent Ministry value case confirms feedback from Ministry staff that the costs of meeting a Green Star 5-Star standard are no longer a major barrier in new schools, there are still a significant number of barriers to implementing SLE in existing schools. One of the most commonly quoted barriers to building development in schools (in fact most green building) is the perceived additional cost of building green buildings over 'normal' buildings. It is unfortunate that early green building may have focused on expensive technological solutions to energy efficiency, such as solar energy generation using photovoltaic technology. The myth of 'too expensive' green building persists. Birkeland (2008) clearly disagrees with this 'myth' and supports challenging those who say green buildings are too expensive, whether this is a conscious position or an unconscious view. The figures from the MoE and others do appear to support Birkeland's position.

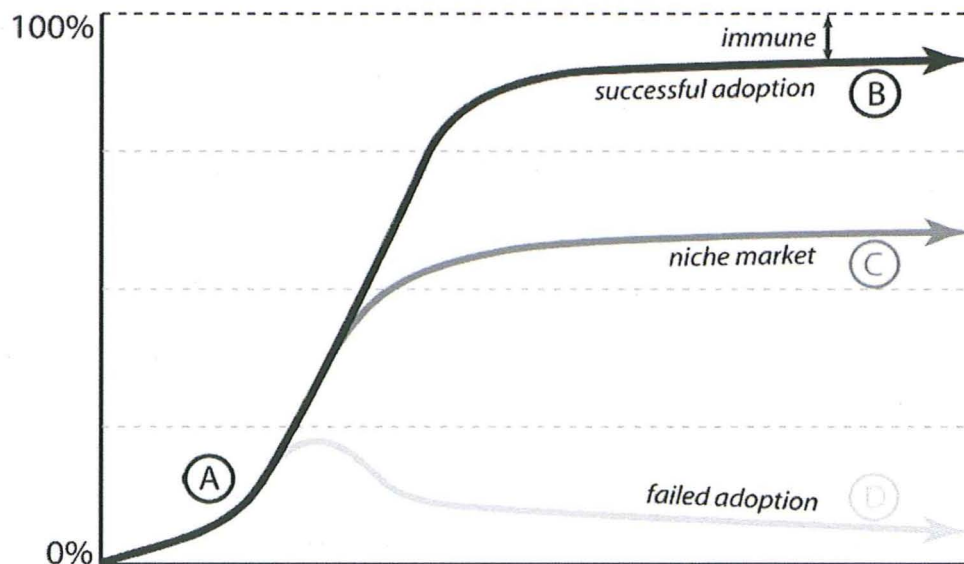
Pearce (2009) lists ten barriers to the acceptance of sustainable design. They are:

1. ***Perceived economic impacts*** – sustainability projects cost more up front, even though they may offer life cycle cost savings.
2. ***Resistance to change*** – stake in the status quo; lack of appropriate trigger to drive change
3. ***Lack of necessary knowledge*** – ties to risk of failure, lack of awareness of sustainability goals by all stakeholders
4. ***Risk of failure*** – products don't perform as anticipated, expected returns on investment don't materialize, and people lose credibility
5. ***Lack of management buy-in*** – upper levels of management get in the way and fail to provide necessary resources
6. ***Lack of resources*** – lack of time, money, people to devote to the challenge of implementing sustainability, ties back to lack of management buy-in
7. ***Lack of incentives/rewards*** – no benefits to change agents for doing things differently, and no penalties for staying the same
8. ***Unclear payoffs/measures of success*** – uncertainty about the true impacts of sustainable solutions, traditional metrics may penalise sustainable programmes
9. ***Existing procedures/standards*** – communication and information failures allow sustainability features to be "value engineered" out of a project, procurement issues
10. ***Conflicts with other requirements*** – the possibility the implementing sustainability strategies may compromise other performance areas (p. 17).

According to Pearce many of these barriers have similar root causes: lack of knowledge and lack of information.

Another view of the barriers to green schools is that of Hoffman and Henn (2008). They suggest an adoption curve for green building that puts it at an early stage on the adoption curve (site A in Figure 4). Hoffman and Henn note that “participants certainly don’t intend to build in an environmentally *harmful* way” but that unrecognized cognitive and social barriers stand between the technical and economic solutions... and the successful construction of a green building”.

Figure 4: Adoption curve for green buildings (Hoffman and Henn, 2008).



Hoffman and Henn examined a number of issues around cognitive decision making in relation to green buildings and agree with Pearce that one of the barriers to the successful adoption curve for green building may be lack of knowledge or literacy with regard to environmental issues. They suggest that “this lack of literacy makes the link between energy conservation and climate change more difficult to understand and creates a reduced sense of urgency or motivation for addressing environmental issues, much less to develop green building practices” (2008).

Tim Cotter in his *Wake-up Call* newsletter (June, 2009) also discusses the concept of learned helplessness as a barrier to green building. Learned helplessness is when people do not make an effort because they cannot see that their behaviour will help or modify a situation. For example, 'Nothing I do will stop global warming so I won't do anything', or as Cotter says, also using climate change as an example, "there is plenty of evidence that inaction with relation to environmental issues is based on the sense that we have no control, in other words, that we are helpless" (2009). This is one reason for avoiding linking SLE with climate change. An individual may be persuaded that they can influence SLE in their school more easily than they can contribute to reducing global warming. Like many other barriers to SLE the root cause of learned helplessness appears to be lack of knowledge and information.

3.5 Conclusion

Definitions of sustainability often have similar desired outcomes: saving resources, providing equity and preserving (or regenerating) the environment. No one definition appears to cater for all and many people and organisations adapt or create definitions to suit their own purpose. In this case, a definition of SLE has been created to guide the development of SLE.

Sustainable Learning Environments are environments designed using applied good sense to:

- minimise resource use
- improve the comfort, health, and safety of occupants
- limit detrimental effects on the environment.

This definition applies both to new and refurbished schools and complements the Ministry's MLE policy.

The building industry wants to measure its success in creating green buildings and a number of environmental rating tool systems have been created to do so. Those systems are generally green or incremental rating tools, measuring incremental improvements from current practice, as opposed to tools that have sustainability as an explicit goal. The Ministry has adopted a Green Star environmental rating tool to manage the creation of greener new schools. In order to manage the introduction of SLE into existing schools some method of measuring a schools current and future levels of sustainability may be useful.

Such a tool could be used to manage SLE and as a teaching and learning tool, although it may be that existing schools, who already feel that time and budgets are stretched, may not be welcome the addition of an environmental rating tool. This is despite research based around green rating tools that suggests the hard financial benefits of sustainable building may outweigh the costs, and that there may be substantial soft benefits, including health, learning, achievement and ultimately financial reward.

There are still a number of barriers to achieving SLE. According to Pearce and others, many of these barriers have similar root causes: lack of knowledge and lack of information. If knowledge and information are key causes of barriers to the achievement of sustainability, then to promote sustainable learning environments in schools, those areas need to be exploited.

Research on the level of sustainable building knowledge, attitudes and sustainable information needs in schools would be useful in order to come to some conclusions about the need for a SLE policy and/or tools.

Further research on the hard and soft costs and benefits, similar to Kats but in a New Zealand context, would also be useful but may need to wait until sufficient Green Star schools have been built in New Zealand.

4 RESEARCH INTO KNOWLEDGE, ATTITUDES AND POLICY

4.1 Introduction

This paper has introduced the concept of SLE, provided some context for SLE in terms of current Ministry property policy for schools, and reviewed the literature around sustainability, sustainable building and how to measure its success, and the costs and benefits of sustainable school building. The development of policy normally includes consultation with those most affected. In this case, no policy exists so an exploratory survey of school principals was written prior to determine:

- their level of knowledge of the subject
- the degree of importance they attach to the subject
- their views on potential solutions
- the best way of providing further information.

Another benefit of using a survey is that the respondents may begin to reflect upon and engage with the topics surveyed.

In taking the decision to survey schools the first consideration was to determine if the information was already available. After extensive research no evidence was found that the information required was available, so it was decided to complete a questionnaire based survey.

4.2 The survey

4.2.1 Aims and goals

Aim

The aim of this survey was to identify information needed to inform and guide the development of SLE policy within the Ministry.

Goals

The survey had the following goals:

- to understand the level of knowledge about sustainable development issues in schools
- to explore the school attitudes to sustainable development in schools
- to ask the respondents what are their preferred methods of inquiry and delivery for knowledge and information about sustainability.

This information, while possibly having some effect on the design of the policy, is important because the current levels of knowledge of the respondents, and their attitudes will have a direct bearing on how a SLE policy would best be implemented. For example, an environmental rating tool can be mandatory or optional and may be used by the school or the school's project manager.

A copy of the survey questionnaire is attached in Appendix 1

4.2.2 Methodology

Sampling issues

The main sampling issues to be considered were the population to be surveyed and the sample selection method. As noted by Statistics New Zealand "everyone has to have a measurable chance of being selected" (SNZ, 1995, p. 34).

The population

There are a number of participants in any school that might hold the relevant attitudinal and other response information regarding SLE. These include board members, principals, staff (teaching, property and administration), students and members of the wider school community.

In most areas, including property, the one person who has an overview of all areas of the school is the principal. The target population for this survey was therefore all school principals in New Zealand state schools.

In this case, the survey population (those who have a chance of being selected as part of the sample) is the same as the target population.

The sampling frame in this case was a physical list of principal's email addresses. This met Statistics New Zealand's list of factors of a good sampling frame (1995). All principal's were counted, were counted once, were distinguishable from each other and the information was up-to-date.

Sample size and randomisation

A sample size of 480 was chosen using an on-line sample calculator with a confidence level of 95% and a confidence interval of four (Creative Research Systems, 2010). Simple random sampling was then used to choose the 500 schools. This means that "every unit of the population has a measurable chance of selection" and "allows sampling errors to be calculated and an accurate estimation of population characteristics to be made" (SNZ, 1995, p.36). The sample was randomised using Microsoft EXCEL's '=RAND()' function. The function puts a random number between 0 and 1 in each cell next to the school's email address. The columns were then sorted by the random numbers and the first 500 schools on the list chosen (adding 20 schools in case of non-delivery of emails, mainly through changes in email provider and therefore address).

Delivery Method

The survey was delivered using SurveyMonkey, a commercial web-based survey software and writing tool. Web-based surveys allows fast, inexpensive responses from any sample size, collect and collate the responses, and provide some basic reporting. The use of other survey

methods was considered but time and cost factors were overwhelmingly in the favour of a web-based survey. Postal surveying would incur the cost of postage both ways and the time cost, due to additional time being needed to send, receive and collate responses. Personal interviews were considered as an alternative but were deemed impractical and would have been limited in geographic scope and size.

The major disadvantage of web-based surveys seems to be around the delivery method. Many people do not look favourably on receiving more email. However, in this case, the emails were going to a restricted group of education professionals from a Ministry employee and to the potential benefit of the Ministry. Other disadvantages of web-based surveys include lack of universal internet access, people quitting in the middle of questionnaires, possible lack of control over who replies and no control over multiple responses. In this case, all schools have internet access and the other issues noted above are controlled through the survey software.

Survey Trial

A draft copy of the survey was trialled through a small number of Ministry staff. The trial produced a number of helpful comments and questions that were used to develop the survey to its final form. The survey trial was completed online. This was successful and addressed concerns about the use of this type of software and the delivery method.

Non-responses

In order to minimise non-response the following procedures were applied:

- assurances of confidentiality
- limiting response time to under 10 minutes (and notifying respondents of this)
- using two rounds of reminder emails.

One of the downsides noted during the delivery of the survey was the number of 'undeliverable' surveys. From an initial 'mail out' of 500 emails, 23 were not able to be delivered.

Of the remainder 94 began the survey and 85 completed it. This is a response rate of 18% which is disappointing. SurveyMonkey considers 30% to be average for an online survey. The low response rate may be due to a number of factors including the time of the survey (early in the school term) and the time pressures and general email traffic faced by principals. While the response rate was low, the final results varied little from the point where 20 or so respondents had completed the survey to when 85 had completed. This does suggest that the results may not have varied widely from those recorded had more respondents replied. The survey was intended to gather information on knowledge and attitudes and even with a low response rate has provided some useful information.

4.2.3 The survey questions

The survey asked 18 questions. The first two questions were general information questions, aimed at eliciting some basic information while attempting to build up confidence in the survey.

This was followed by five questions on the respondent's knowledge of sustainable building issues, three questions regarding attitudes to sustainability, four questions about environmental assessment tools, and three questions asking where they preferred to seek information, in what form, and what sustainability topics might be of most interest.

While questions around the barriers to implementing sustainable learning environments would also have been useful, it was felt that those barriers may be similar to barriers generally expressed by schools such as funding, resources and knowledge. Also, the survey length was kept short in an attempt to elicit a useful number of responses.

5 ANALYSIS

5.1 The Respondents

The survey was aimed at principals as they are generally the main representatives of schools. While various members of the school community have responded, principals have done so in the main. This suggests that the remainder of the results will have some validity as a gauge of the knowledge and attitudes of those most likely to guide opinion and make decisions on sustainability within schools. In Question 1, 'Others' identify themselves as Deputy and Assistant Principals and executive officers.

Figure 5: Question 1 - Survey respondents by type.

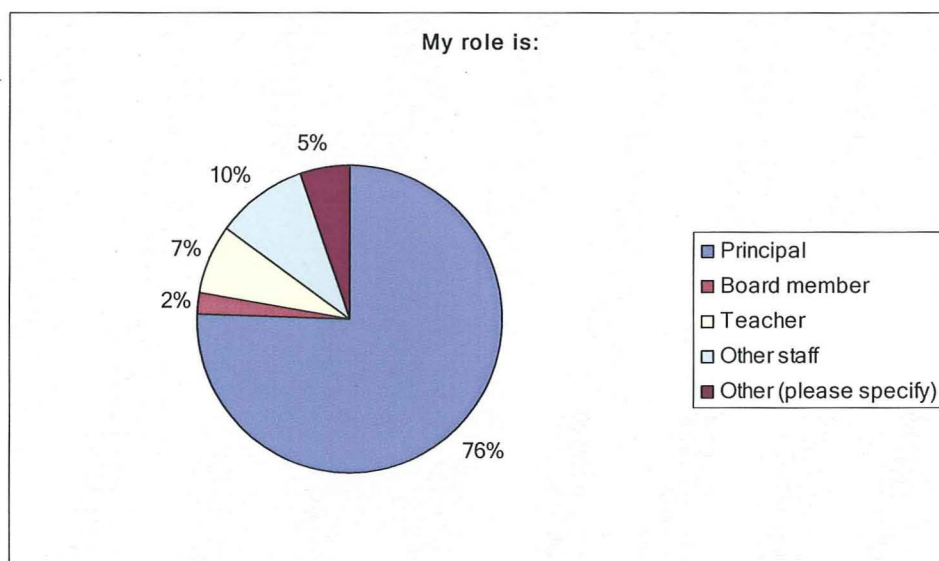
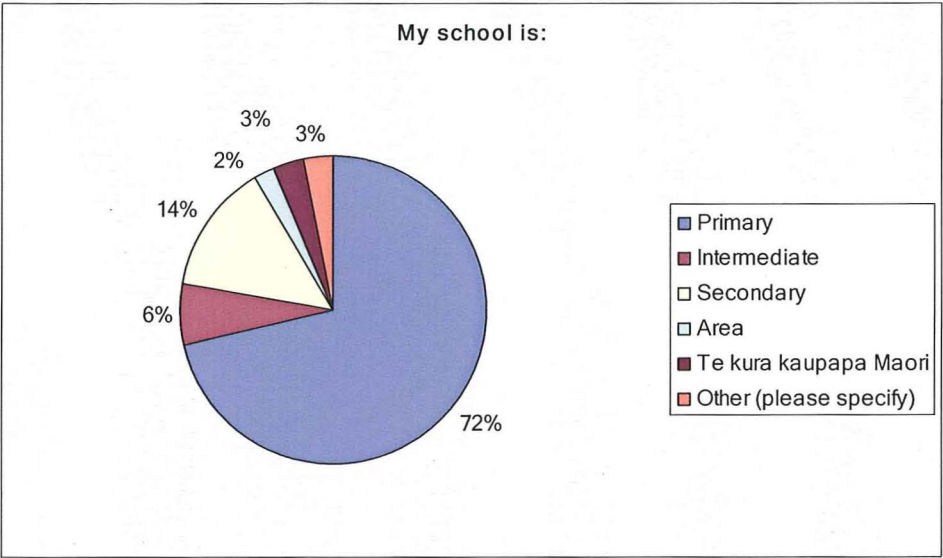


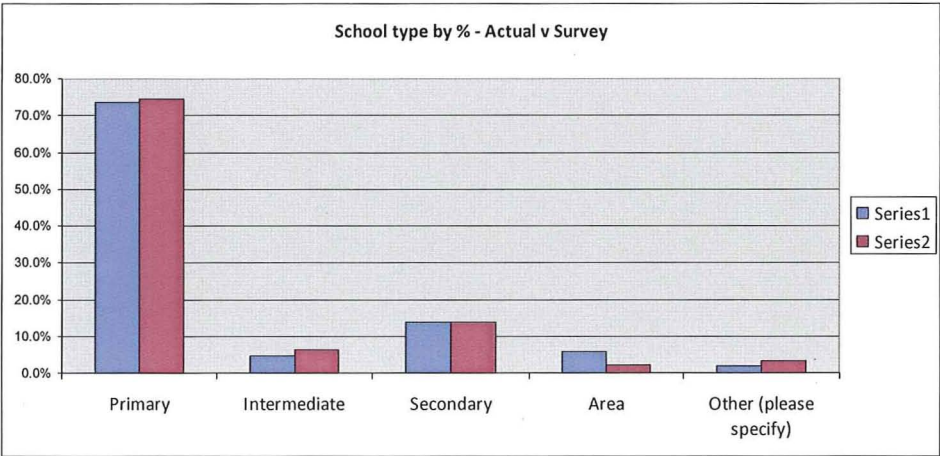
Figure 6 shows the number of schools that responded to the survey as a percentage by type (Ministry definitions). In the diagram, 'Other' is a number of primary schools that made the distinction between full primary (years 1-8) and contributing primary (years 1-6) schools.

Figure 6: Question 2 - Schools by type.



These have been realigned to be more easily compared to the actual % by sector (primary, secondary, composite, special) in Figure 7. The school sector figures are the latest available from the Ministry website and are as of end June 2009.

Figure 7: Schools and respondents by sector (July roll returns, 2010).



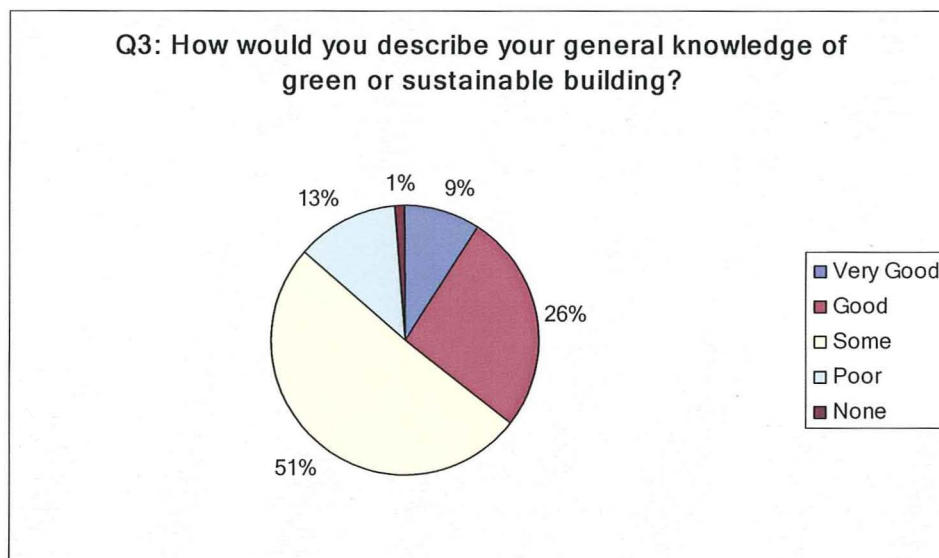
The % of each type of school by sector that responded to the survey is very close to the actual % of schools in each sector. This suggests that the results of the survey might properly reflect the weight of opinion from different school types, with primary schools forming a large majority of schools in the country. The number of primary schools may also reflect

the relative importance of the role primary schools could play in promoting sustainable attitudes and behaviours.

5.2 Knowledge of sustainable building issues

The survey asked a number of questions about the respondent's knowledge of sustainable building issues, from general to specific knowledge. In Question 3, respondents were asked to describe their general knowledge of green or sustainable building. Overall, 86% of respondents said they had "some", "good" or "very good" knowledge of green or sustainable buildings, with 26% having 'good' and 9% 'very good' knowledge.

Figure 8: Question 3 – General knowledge of sustainable building.



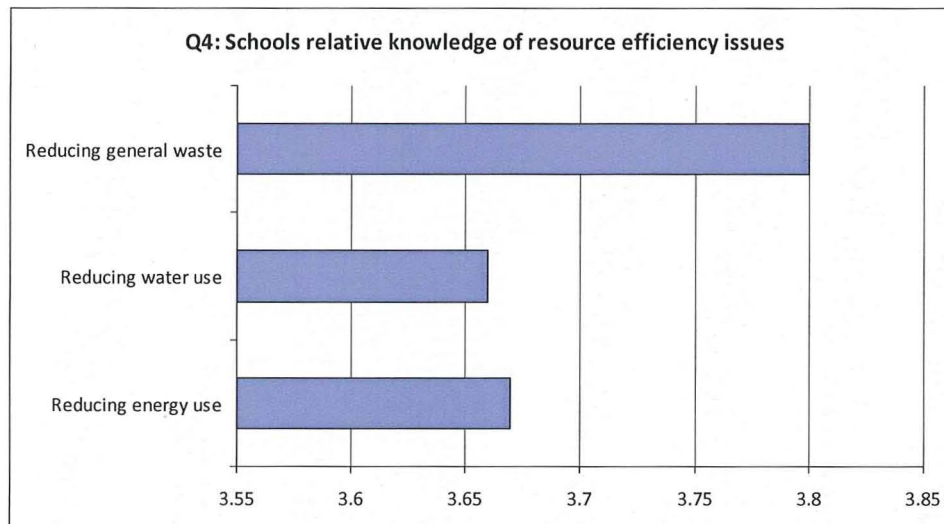
On a school sector basis, primary schools showed more respondents with 'some' knowledge than secondary schools, with secondary schools showing a greater percentage with 'good' or 'very good' knowledge. Secondary schools had more schools with 'poor' knowledge.

While impressed by the level of knowledge admitted by all schools (higher than expected), secondary schools higher levels of 'good' and 'very good'

may be explained by them more often employing executive officers, property managers and others whose role is primarily property focused.

When further questioned about their knowledge of the costs and benefits of resource efficiency in the areas of energy, water and waste (Question 4), 45%, 41% and 51% of respondents respectively said they had a good level of knowledge of resource efficiency. The % of those with some, good or very good knowledge is above 80% in all cases. Figure 9 shows the relative knowledge of schools of resource efficiency issues.

Figure 9: Question 4 – Knowledge of resource efficiency.

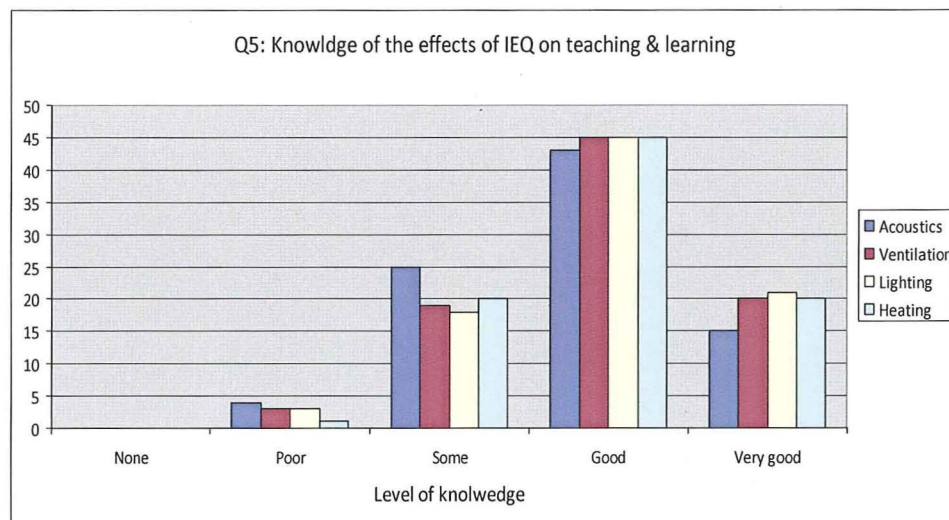


This appears to be a fair reflection of the time and resources that have been put into waste reduction over the last few years. For example, waste became an issue when most school incinerators were shut down recently. Schools were therefore incentivised to better understand and manage their waste. The sustainable management of energy and water currently has few financial incentives for schools. This may explain why schools currently have relatively less knowledge in those areas. While energy efficiency information is available to schools, minimal effort has gone into promoting energy efficiency and less to water efficiency.

In Question 5, respondents were asked about their knowledge of the effects of IEQ (heating, lighting, ventilation and acoustics) on teaching and learning.

The level of knowledge about IEQ across the four IEQ areas was high, with similar levels of knowledge of the effects of IEQ across all four areas. In general, around 70-75% of respondents claimed good or very good knowledge, around 20% some knowledge, a few % poor knowledge, and none claimed no knowledge.

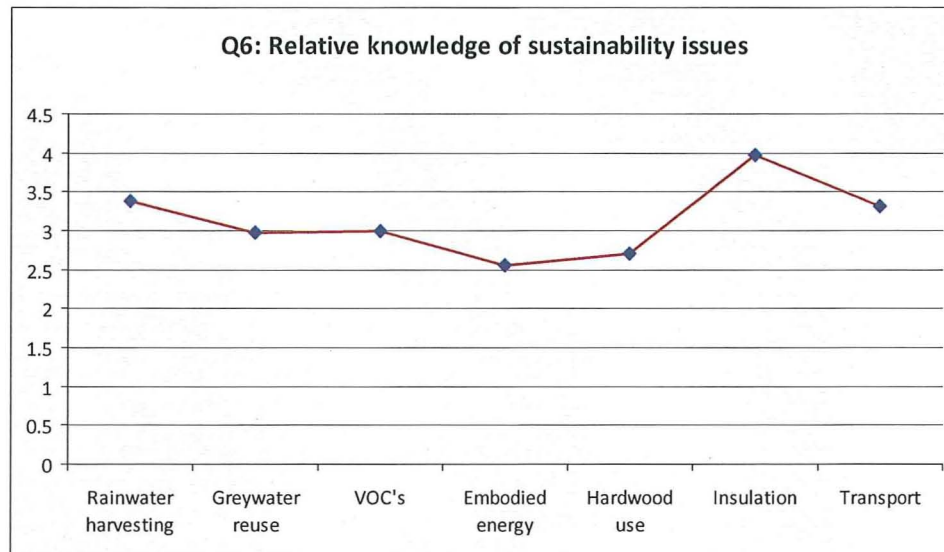
Figure 10: Question 5 - Knowledge of the effects of IEQ.



In general, more respondents claimed knowledge of resource efficiency than IEQ. This may be related to the fact that schools pay the hard costs of their resources, but see none of the soft benefits of good IEQ. Also, waste and energy have much higher public profiles.

Question 6 then asked about schools' knowledge of a number of specific issues related to wider sustainability or environmental concerns. The response varied and the relative levels of knowledge claimed for each subject can be seen in Figure 11.

Figure 11: Question 6 - Relative knowledge of sustainability issues.



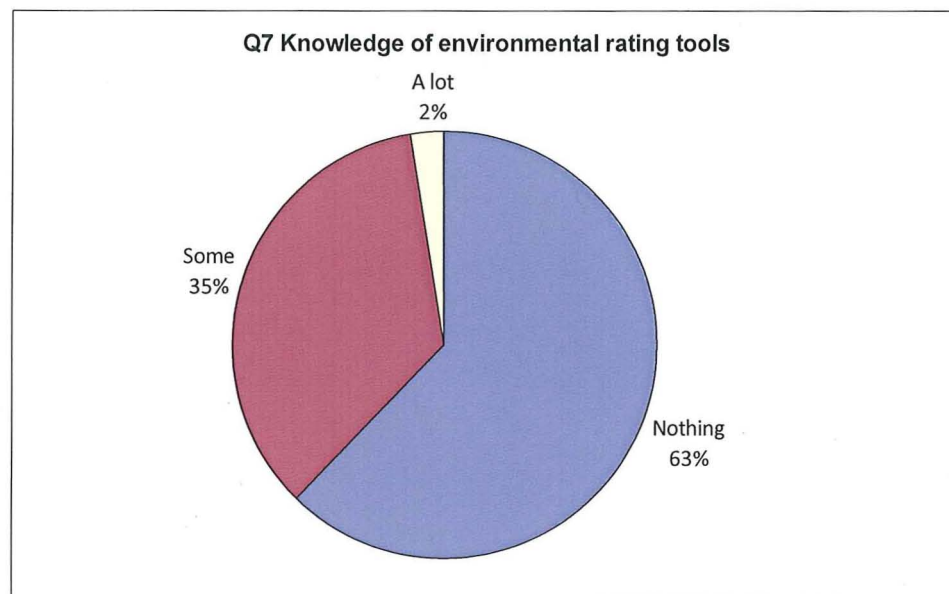
Not surprisingly, schools claim the most knowledge of those issues with a higher public profile. Insulation and transport options are probably both personally and professionally relevant to school staff with 95% and 80% of schools respectively claiming some, good or very good knowledge of the issues. The issues around embodied energy and the use of tropical hardwoods are less well known with 50% and 41% respectively claiming no knowledge or poor knowledge of the issues.

Perhaps most surprising was that 77% of respondents claimed some, good or very good knowledge of rainwater harvesting and reuse. While rainwater harvesting is a part of the Green Star Education tool for new schools and has been implemented in at least two new buildings in existing schools, its profile appears not to be as high as insulation or transport. This result suggests that it is more widely known and accepted.

Some of the high level of positive response to some issues may be due to the number of schools that are now part of the EnviroSchools programme. EnviroSchools promotes environmental programmes and learning and has been accepted into around 800 schools (about one third of all schools).

The final knowledge questions asked about environmental rating tools for buildings. Question 7 asked what respondents know of rating tools and Question 8 asked if respondents had heard of specific tools.

Figure 12: Question 7 – Knowledge of environmental rating tools.



The level of knowledge appears low overall. If it is decided to introduce a rating tool, a good communications plan will need to be part of the implementation plan.

In regard to specific environmental rating tools, while 18% had heard of Green Star, less than 5% of respondents had heard of LEED or BREEAM, and only 1.2% had heard of NABERS. Green Star may be better known because of its use by the Ministry in new schools.

5.3 Sustainable building attitudes

Questions in this section attempted to identify respondent's attitudes to sustainable building. The questions asked how important environmental and sustainability issues are to respondents, how they would rank in importance the three SLE issues, and whether or not schools have a role in promoting sustainable behaviours and environmental awareness.

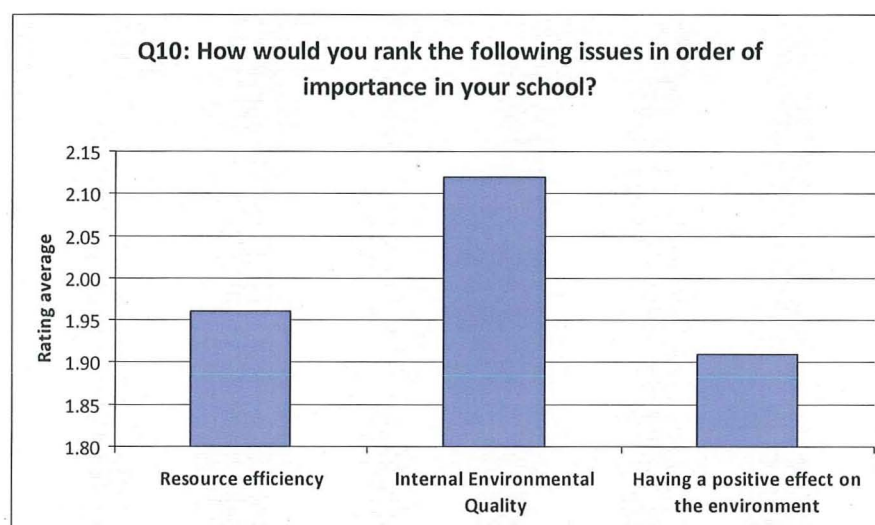
Question 9 asked if environmental and sustainability issues were important to the respondents. Over 90% of respondents thought that environmental and sustainability issues were either somewhat important (34%) or important (60%)

Question 11 asked if the respondents thought that schools have a role to play in promoting sustainable behaviour and environmental awareness. 90% of respondents said yes, 9% said maybe and 1% said no.

Answers to these questions suggest that respondents strongly support sustainability and believe it should be a part of the schools teaching and learning. This points to schools being very responsive to SLE messages and tools. While there may be an element of not wanting to record a negative opinion in the results (who wants to answer that they don't care about the environment?) the high percentage of positive responses suggests that schools do see themselves as supportive of sustainability.

In terms of how important the three parts of the SLE are to schools, Figure 12 shows the relative importance to schools of resource efficiency, IEQ and the wider environment. This agrees with the Ministry's current view that IEQ is most important because of its potential to positively affect learning outcomes for students and improve staff performance.

Figure 13: Question 10 - The importance of SLE issues.

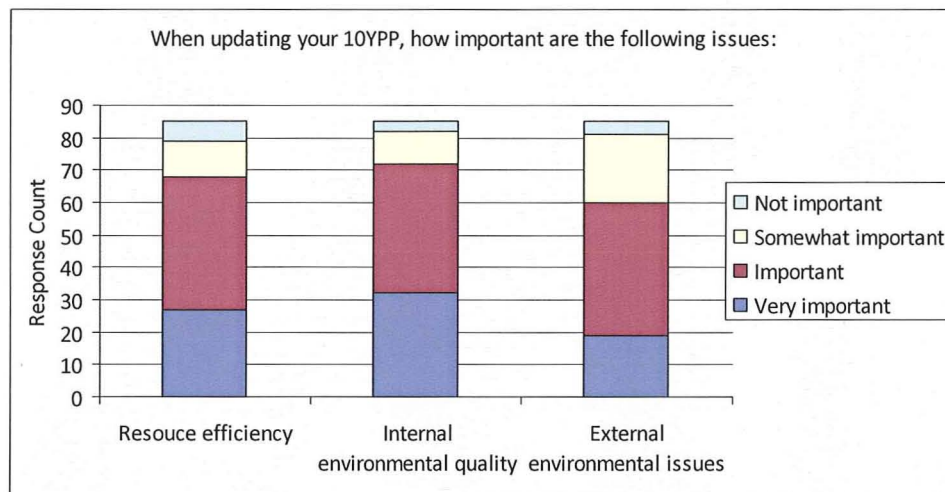


5.4 SLE policy options

This set of questions attempted to provide guidance on the respondent's preferences in terms of the delivery of an assessment tool or policy options.

While Question 12 was somewhat similar to Question 10, the question was posed about the importance of SLE issues in relation to a school's formal property planning process, rather than as stand alone issues ranked against each other.

Figure 14: Question 12 – Importance when updating property plans.



In both Questions 10 and 12 IEQ rated highest, with over 80% suggesting that IEQ in property planning was important or very important. Nearly 80% rated resource efficiency as important or very important with external environmental issue behind this on about 70%. Again, the relative importance suggested by Question 12 is similar to that of Question 10. Taken together, these questions may be a good indication of the true importance of each issue.

Figure 14 also shows more respondents rated the environment somewhat important than rated efficiency somewhat important. It would be interesting to compare these ratings with a similar rating after changes to school Heat, Light and Water funding begins in July 2010.

Given that IEQ may have the most impact on student learning outcomes, it is appropriate that IEQ was ranked the most important of the SLE issues in both Question 10 and 12. This suggests that while schools refurbishing existing buildings may focus on creating good IEQ, a priority within the Ministry, resource efficiency and the environment will not be forgotten. In terms of environmental rating tools, if IEQ is rated as part of the Ministry's MLE tool, resource efficiency should perhaps be the key rating area in an SLE rating tool.

Questions 13, 14 and 15 asked schools their views on the usefulness of environmental rating tools, when they would prefer to use such a tool and whether a tool designed to also be used by teachers and students would be useful.

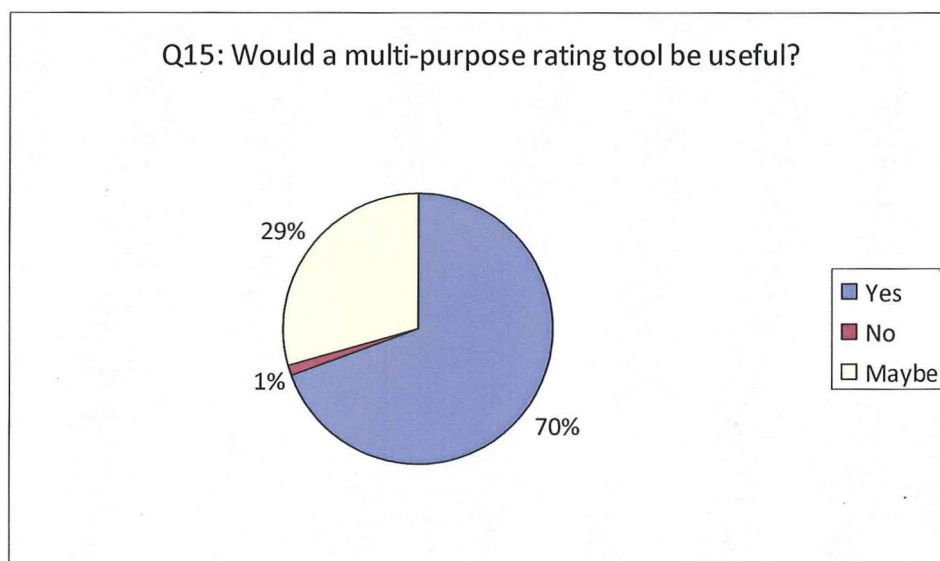
In response to Question 13, nearly 60% of respondents said that a rating tool would be useful with the remainder saying that it may be useful. No respondents replied that a rating tool would not be useful. This suggests that a rating tool would probably be a useful tool for schools, giving them the ability to rate their sustainability, compare to other schools and eventually to also allow the Ministry to set some performance benchmarks.

Respondents were then asked in Question 14 whether they would prefer a rating tool that could be used anytime, as part of their 10-Year Plan condition assessment process, or not at all. Given the previous results, it was thought that schools would most prefer to use such a tool as part of their property planning cycle, where it would typically be managed by the schools professional property manager. That 49% responded yes to a tool that could be used anytime was surprising. It perhaps reflects the 100% yes-maybe response to whether such a tool would be useful, and an understanding of the need to measure what you manage

In response to Question 15, 69.4% of respondents replied that a rating tool that could be used as part of their 10-year planning cycle would be preferred. The remaining 3% preferred not to use a rating tool at all.

Question 15 asked if a rating tool that could be used as a management tool, learning tool and by their project manager would be useful. Sixty-nine per cent responded that it would and 29% maybe.

Figure 15: Question 15 - Teaching and learning rating tool.



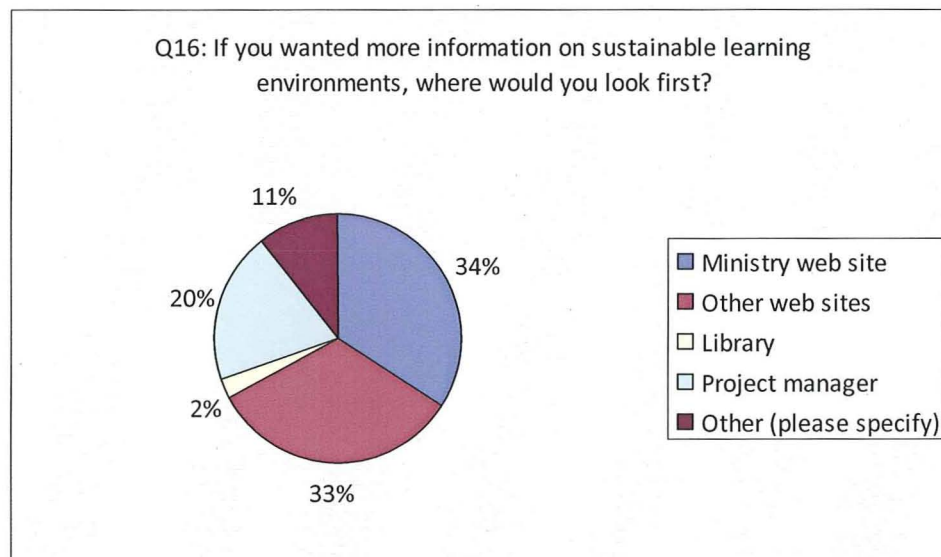
This is useful information in terms of the choice or development of a tool. The Australian NABERS tool for example, is web-based, and its results can be made available for all or any users. Many New Zealand primary schools have water and energy curriculum strands in years seven and eight and the ability to calculate their water and energy use online may be useful. An example of how this can and does work is provided by the Genesis 'Schoolgen' programme. This programme has seen 42 solar photovoltaic systems installed in schools. The systems are linked to the internet and can be observed in real time.

5.5 Information on sustainable learning environments

The final section of the survey was designed to identify how schools would prefer to receive further information on sustainability and about what topics.

In Question 16, 67% of respondents said they would first look for information on the internet, with an even split between those that would first check the Ministry's website and other websites. Twenty per cent suggested that they would ask their school project managers. Twenty per cent suggested that they would ask their school project managers.

Figure 16: Question 16 – Where do you look for information?



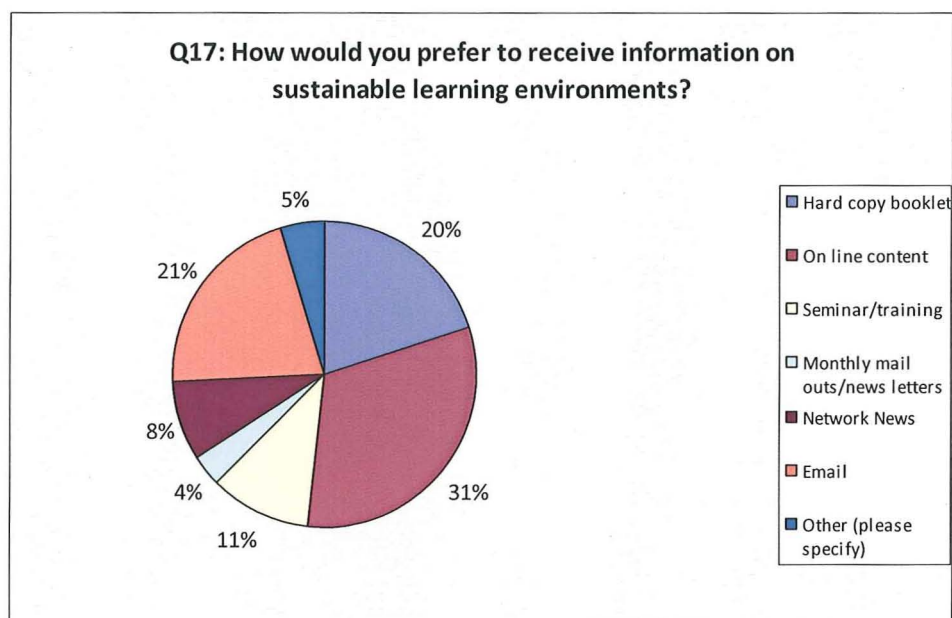
Of the nine responses in the category 'Other', four gave internet related answers, while the remainder would use human contacts or 'research and readings'.

Question 17 asked how respondents would prefer to receive SLE information.

Of most interest is that the majority of respondents opted to seek their information from the internet and preferred to receive information electronically in some form (64%). This strongly suggests that a communications plan or SLE related documents need to be web-based.

'Other' was evenly split between 'a combination of methods' or 'all of the above'.

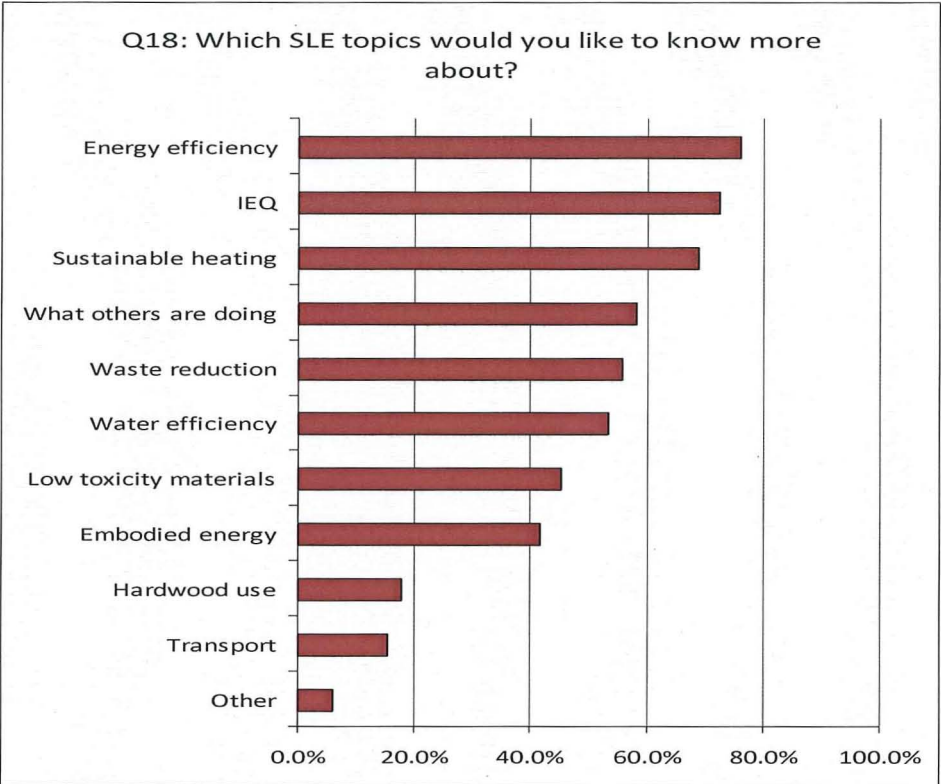
Figure 17: Question 17 – How should we send information?



This survey could also have asked what form respondents preferred SLE information to be presented, such as case studies, reports or 'how to' information.

The final question, Question 18, suggested a range of sustainable building topics covering all three areas of SLE and asked what subjects respondents would like more information about. The responses could be used to guide the Ministry toward topics that are of most interest to schools. This would help keep information for schools relevant and useful. The results are shown in Figure 15 with 'Others' seeking information on 'all topics', 'anything useful' and 'traditional Maori pre-European sustainable knowledge'. While not specifically mentioned, that over 50% of respondents chose 'what others are doing' suggests that case studies may be a useful means of communicating with schools.

Figure 18: Question 18 – Further information.



5.6 Conclusion and recommendations

5.6.1 Introduction

The Ministry has a policy aimed at creating SLE in new schools, mandating the use of the NZGBC Green Star Education environmental rating tool. The aim of this policy is to guide the design and building of new schools to a 5-star or New Zealand Excellence level of sustainability. As the Ministry of Education has about 2400 schools, efforts to create sustainable learning environments now need to concentrate on existing schools.

A necessary part of the policy design process is to consider ideas and alternatives and test them with those whom the policy is aimed at. This dissertation set out to provide information that would inform the development of a policy statement on Sustainable Learning Environments (SLE).

5.6.2 Conclusion

Sustainability is a large and multi-faceted area and many aspects of sustainable development, sustainability, and environment meet in the development of SLE policy. A number of those areas have been examined with respect to SLE policy but many areas for further research remain, particularly in creating benchmarks and determining the real costs and benefits of sustainability in schools and school buildings in New Zealand.

There are many definitions of sustainability and they share similar characteristics such as conserving resources, caring for the environment and intergenerational equity. It has been argued that there is no one-size-fits-all definition and that specific definitions need to be created to ensure understanding within a specific subject area or organisation. In terms of SLE, a specific definition has been created to give a common understanding of SLE.

The literature review also looked at the costs and benefits of SLE, both hard and soft. It appears that the hard financial benefits of SLE for new schools are clearer and more easily verifiable than the soft financial benefits, which are not at all certain and currently difficult to verify. Much more research is needed in these areas. In terms of the benefits of IEQ on teaching and learning outcomes there is some evidence that good IEQ can improve learning outcomes. Again, further research is needed in this area.

The need to measure green progress in new school design has led to the introduction of environmental rating tools. Provision of some form of environmental rating tool for existing schools was suggested as a means of assisting schools to implement a SLE policy. From the survey it appears that schools have little knowledge of environmental rating tools but that the concept is strongly supported. This included support for a rating tool that can be used for teaching and learning as well as for management purposes.

While a good proportion of schools suggest they would use a rating tool 'anytime', it may be that mandatory use as part of the schools property planning cycle would give better coverage and better benchmarking data. The tool could also be used at other times for teaching and learning and monitoring progress towards sustainability. The use of a rating tool could help schools identify where they need to concentrate their efforts and could help the Ministry target information for schools.

Following a review of SLE related literature it was decided to survey schools to gain a better understanding of their knowledge, attitudes and needs around SLE.

From those that responded to the survey, it is clear that schools have a reasonable knowledge of some sustainability issues but want further knowledge in a broad range of areas. Levels of knowledge do differ between primary and secondary schools but not to a great extent. It may

still be useful to match different knowledge areas to different types of schools and to provide more in-depth information to some types of school.

The survey showed that attitudes toward sustainability and environmental issues are generally very positive. The high levels of positivity were, in fact, unexpected. However, those attitudes may allow the Ministry to concentrate on providing advice and information that leads to action, rather than having to spend time and money raising awareness of the issues. The literature supports the idea of providing practical 'can do' information, suggesting that information on sustainability needs to be provided in a context that enables individuals and schools to feel that they can make a difference, rather than contributing to feeling of helplessness.

Also unexpected was the strength of the message that information delivery needs to be via computer using multiple channels – email, websites and while not specifically mentioned, possibly social networking sites.

5.6.3 Recommendations

Based on the literature review and research survey a number of conclusions have been drawn about the issues affecting SLE policy in schools. While there appear to be a number of areas that would benefit from further research, particularly in the areas of cost and benefits, the following recommendations are made for the consideration of policy makers.

Defining SLE

It is recommended that a specific definition of SLE, as described in this paper, is agreed as a common definition of SLE across the Ministry and the education sector. A single agreed definition will allow all the participants in SLE to work towards a commonly understood goal or set of goals.

Environmental rating tools

The Ministry should consider the introduction of an 'in-use' environmental rating tool for existing schools, for example the NZGBC 'in-use' tool currently being developed. There is a clear acceptance in schools of the concept of an environmental rating tool that measures a school's environmental performance. The Ministry has so far preferred to use market-based environmental rating tools rather than develop specific tools in-house, due to the costs and need to have ongoing maintenance in-house and this policy is recommended for an in-use environmental rating tool.

Information for the Ministry

There is a lack of information on the costs and benefits of SLE. It is recommended that the Ministry should consider what its SLE information needs are and consider creating a research plan to acquire that information. This may include directly funding research or working with

others to provide the research needed. Issues that might be most useful in terms of advancing knowledge and uptake of SLE in schools include the costs and benefits, the effectiveness of different sustainable refurbishment materials and technologies and full life-cycle costing for materials and equipment used by schools.

Information for schools

There is clear evidence that schools want more information on sustainability issues. The Ministry should look at ways of providing further information and consider creating an online delivery path. Also of use to schools would be case study information from both New Zealand and overseas, showcasing successful sustainable refurbishment.

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7 APPENDICES

7.1 Appendix 1 - Copy of SLE survey questionnaire.

Sustainable Learning Environments

1. Introduction

Thanks for taking the time to complete this survey. I do understand that your time is important.

There are 18 questions and they should take less than 10 minutes to answer. Your responses will be completely anonymous.

For the purposes of this research I have defined the term 'Sustainable Learning Environments' to mean school buildings that:

- minimise resource use (eg energy and water)
- maximise indoor environmental quality (through good ventilation, heating, lighting and acoustics), and
- have a positive effect on the environment.

The terms 'green' or 'sustainable' building have similar meaning.

In order to get through the survey, please click on the following navigation links:

Next - continue to the next page

Previous - button to return to the previous page

Exit - button if you need to exit the survey

Submit - button to submit your survey.

Completion of the questionnaire will be understood as your consent to participate in this study.

* 1. My role is:

- ☐ Principal
- ☐ Board member
- ☐ Teacher
- ☐ Other staff
- ☐ Other (please specify)

* 2. My school is:

- ☐ Primary
- ☐ Intermediate
- ☐ Secondary
- ☐ Area
- ☐ Te kura kaupapa Maori
- ☐ Other (please specify)

Sustainable Learning Environments

2. What do you know about sustainable building issues?

*** 3. How would you describe your general knowledge of green or sustainable building?**

- ☐ None
- ☐ Poor
- ☐ Some
- ☐ Good
- ☐ Very Good

*** 4. Resource efficiency is about using less to do the same job. How would you describe your knowledge of the costs and benefits of:**

	None	Poor	Some	Good	Very good
Reducing energy use	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Reducing water use	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Reducing general waste	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

*** 5. A good indoor environment can affect the productivity of students and staff. How would you describe your knowledge of the effects of the following on teaching and learning:**

	None	Poor	Some	Good	Very good
Acoustics	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Ventilation	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Lighting	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Heating	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Sustainable Learning Environments

*** 6. In terms of wider building related environmental concerns, how would you describe your knowledge of:**

	None	Poor	Some	Good	Very Good
Greywater capture and reuse	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Rainwater harvesting and reuse	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Embodied energy in building materials	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
The use of tropical hardwood	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
The benefits of insulation and double glazing	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Transport choices	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Toxic chemicals in building materials	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

*** 7. Environmental rating tools are used to measure the efficiency and sustainability of buildings so their performance can be managed. How much do you know about rating tools:**

	Nothing	Some	A lot
Generally	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

8. Have you heard of the following environmental rating tools:

	Yes	No
Green Star Education	<input type="radio"/>	<input type="radio"/>
LEED	<input type="radio"/>	<input type="radio"/>
BREAM	<input type="radio"/>	<input type="radio"/>
NABERS	<input type="radio"/>	<input type="radio"/>

Sustainable Learning Environments

3. Sustainable building attitudes

* 9. How important to you are environmental and sustainability issues?

	Not important	Neither important nor unimportant	Somewhat important	Important
The importance of environmental and sustainability issues	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

* 10. How would you rank the following issues in order of importance in your school?

	First	Second	Third
Resource efficiency	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Internal Environmental Quality	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Having a positive effect on the environment	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

* 11. Do schools have a role to play in promoting sustainable behaviours and environmental awareness?

- ☐ Yes
- ☐ No
- ☐ Maybe

Sustainable Learning Environments

4. Sustainable learning environment information and policy options

* 12. When updating your 10YPP, how important are the following issues:

	Not important	Somewhat important	Important	Very important
Internal environmental quality	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
External environmental issues	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Resource efficiency	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

* 13. Improving resource efficiency and sustainability begins with measuring where you are now. Would an environmental rating tool the measures energy efficiency and other sustainable attributes be useful in your school:

	Yes	No	Maybe
Yes/No/Maybe	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Comments

* 14. When would you prefer to use an energy and environmental rating tool:

☐ Anytime

☐ As part of the 10YP condition assessment

☐ Not at all

* 15. Would an energy and environmental rating tool that could be used by you as a management tool, by teachers and students as a learning tool, and by your project manager be useful?

☐ Yes

☐ No

☐ Maybe

Sustainable Learning Environments

5. Information on sustainable learning environments

*** 16. If you wanted more information on sustainable learning environments, where would you look first?**

- ☐ Ministry web site
- ☐ Other web sites
- ☐ Library
- ☐ Project manager
- ☐ Other (please specify)

*** 17. How would you prefer to receive information on sustainable learning environments?**

- ☐ Hard copy booklet
- ☐ On line content
- ☐ Seminar/training
- ☐ Monthly mail outs/news letters
- ☐ Network News
- ☐ Email
- ☐ Other (please specify)

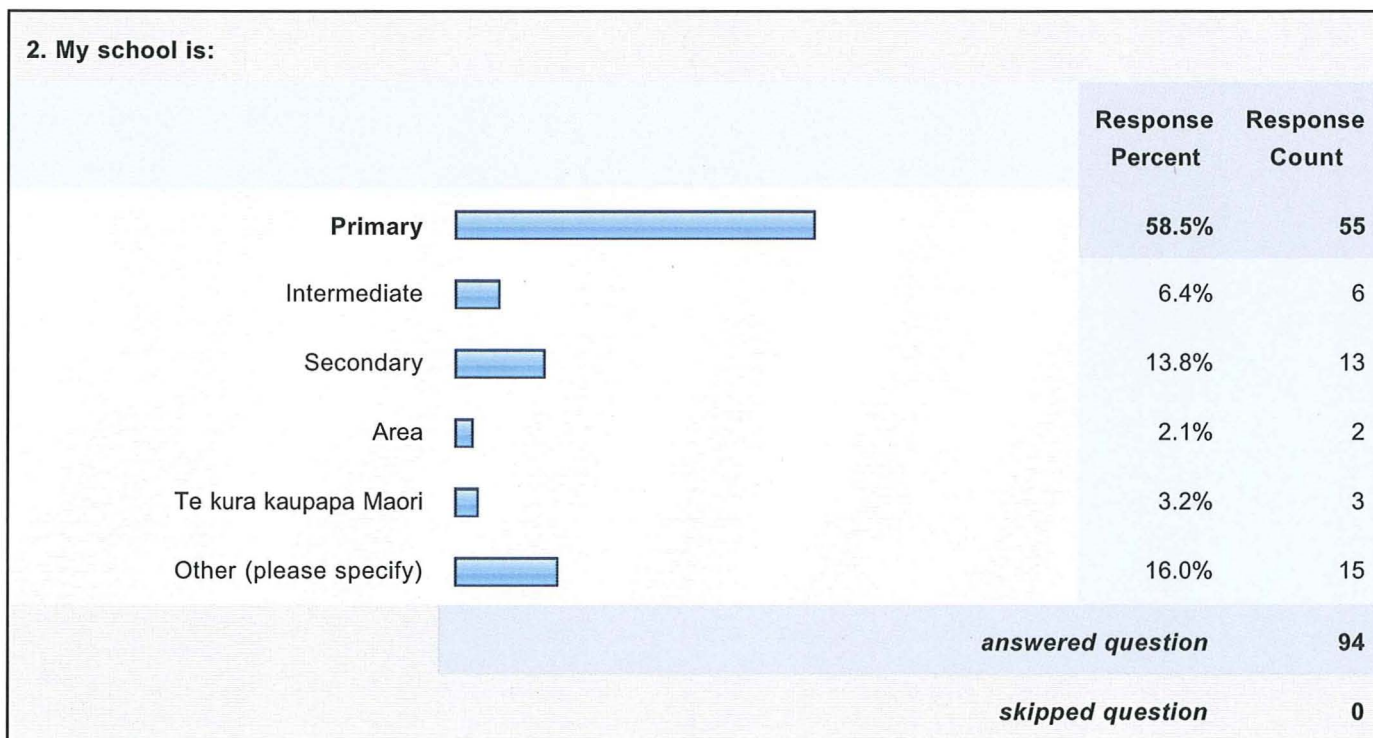
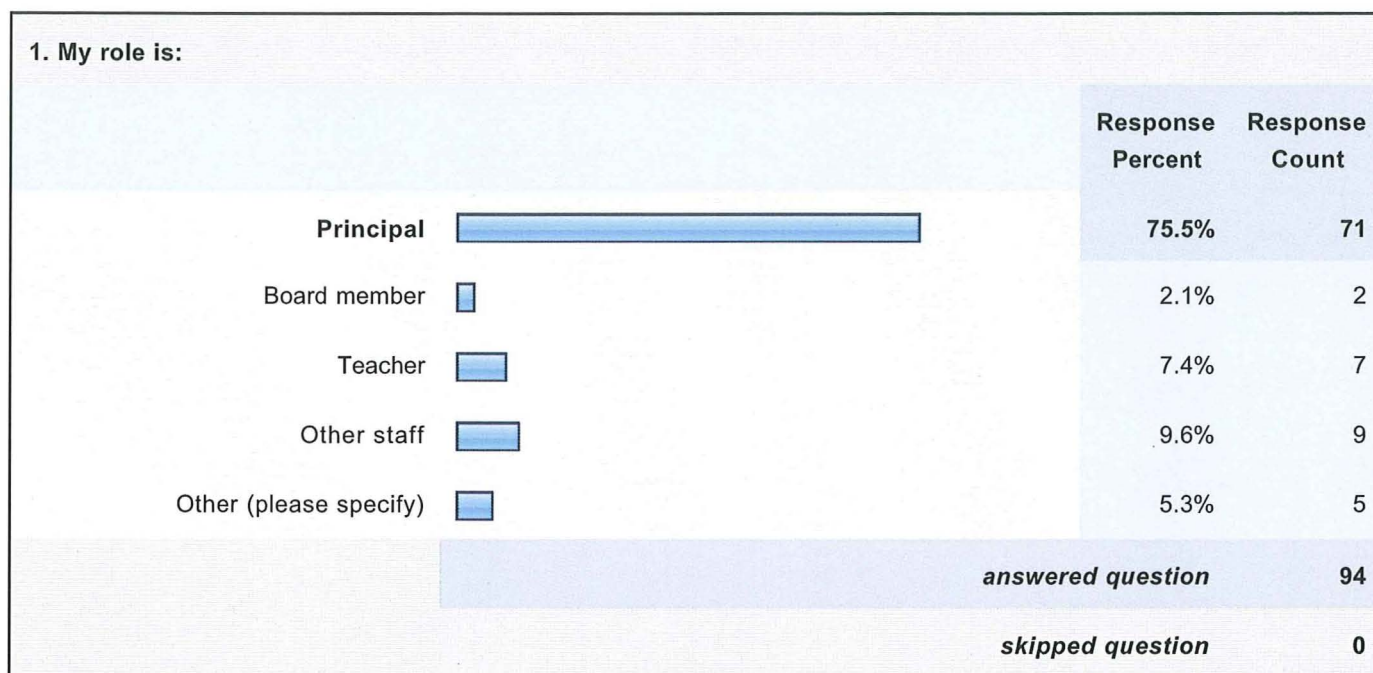
Sustainable Learning Environments

18. What sustainable learning environment topics would you like to know more about, if any (you can choose more than one)?






- ☐ Energy efficiency
- ☐ Water efficiency
- ☐ Waste reduction
- ☐ Indoor environmental quality
- ☐ Sustainable transport
- ☐ Hardwood alternatives
- ☐ Low toxicity building materials, paints etc
- ☐ Embodied energy in building materials
- ☐ Sustainable heating alternatives
- ☐ What others are doing in this area
- ☐ Other (please specify)

7.2 Appendix 2 - Copy of full results from SLE survey.

Sustainable Learning Environments



3. How would you describe your general knowledge of green or sustainable building?

	Response Percent	Response Count
None 	1.1%	1
Poor 	12.6%	11
Some 	50.6%	44
Good 	26.4%	23
Very Good 	9.2%	8
<i>answered question</i>		87
<i>skipped question</i>		7

4. Resource efficiency is about using less to do the same job. How would you describe your knowledge of the costs and benefits of:

	None	Poor	Some	Good	Very good	Rating Average	Response Count
Reducing energy use	0.0% (0)	5.7% (5)	35.6% (31)	44.8% (39)	13.8% (12)	3.67	87
Reducing water use	0.0% (0)	10.3% (9)	31.0% (27)	41.4% (36)	17.2% (15)	3.66	87
Reducing general waste	0.0% (0)	4.6% (4)	27.6% (24)	50.6% (44)	17.2% (15)	3.80	87
<i>answered question</i>							87
<i>skipped question</i>							7

5. A good indoor environment can affect the productivity of students and staff. How would you describe your knowledge of the effects of the following on teaching and learning:

	None	Poor	Some	Good	Very good	Rating Average	Response Count
Acoustics	0.0% (0)	4.6% (4)	28.7% (25)	49.4% (43)	17.2% (15)	3.79	87
Ventilation	0.0% (0)	3.4% (3)	21.8% (19)	51.7% (45)	23.0% (20)	3.94	87
Lighting	0.0% (0)	3.4% (3)	20.7% (18)	51.7% (45)	24.1% (21)	3.97	87
Heating	0.0% (0)	1.2% (1)	23.3% (20)	52.3% (45)	23.3% (20)	3.98	86
answered question							87
skipped question							7

6. In terms of wider building related environmental concerns, how would you describe your knowledge of:

	None	Poor	Some	Good	Very Good	Rating Average	Response Count
Rainwater harvesting and reuse	4.6% (4)	18.4% (16)	31.0% (27)	25.3% (22)	20.7% (18)	3.39	87
Greywater capture and reuse	8.0% (7)	27.6% (24)	35.6% (31)	14.9% (13)	13.8% (12)	2.99	87
Toxic chemicals in building materials	5.7% (5)	24.1% (21)	41.4% (36)	21.8% (19)	6.9% (6)	3.00	87
Embodied energy in building materials	18.4% (16)	31.0% (27)	31.0% (27)	13.8% (12)	5.7% (5)	2.57	87
The use of tropical hardwood	17.2% (15)	24.1% (21)	33.3% (29)	20.7% (18)	4.6% (4)	2.71	87
The benefits of insulation and double glazing	2.3% (2)	2.3% (2)	19.5% (17)	48.3% (42)	27.6% (24)	3.97	87
Transport choices	5.7% (5)	13.8% (12)	31.0% (27)	41.4% (36)	8.0% (7)	3.32	87
answered question							87
skipped question							7

7. Environmental rating tools are used to measure the efficiency and sustainability of buildings so their performance can be managed. How much do you know about rating tools:

	Nothing	Some	A lot	Rating Average	Response Count
Generally	62.1% (54)	35.6% (31)	2.3% (2)	1.40	87
	<i>answered question</i>				87
	<i>skipped question</i>				7

8. Have you heard of the following environmental rating tools:

	Yes	No	Response Count
Green Star Education	18.4% (16)	81.6% (71)	87
LEED	2.3% (2)	97.7% (84)	86
BREAM	4.6% (4)	95.4% (83)	87
NABERS	1.2% (1)	98.8% (85)	86
	<i>answered question</i>		87
	<i>skipped question</i>		7




9. How important to you are environmental and sustainability issues?

	Not important	Neither important nor unimportant	Somewhat important	Important	Rating Average	Response Count
The importance of environmental and sustainability issues	2.3% (2)	3.4% (3)	34.5% (30)	59.8% (52)	3.52	87
	<i>answered question</i>					87
	<i>skipped question</i>					7

10. How would you rank the following issues in order of importance in your school?

	First	Second	Third	Rating Average	Response Count
Resource efficiency	26.7% (23)	50.0% (43)	23.3% (20)	1.97	86
Internal Environmental Quality	30.6% (26)	25.9% (22)	43.5% (37)	2.13	85
Having a positive effect on the environment	43.0% (37)	24.4% (21)	32.6% (28)	1.90	86
answered question					87
skipped question					7

11. Do schools have a role to play in promoting sustainable behaviours and environmental awareness?

	Response Percent	Response Count
Yes 	89.7%	78
No 	1.1%	1
Maybe 	9.2%	8
answered question		87
skipped question		7




12. When updating your 10YPP, how important are the following issues:

	Not important	Somewhat important	Important	Very important	Response Count
Resource efficiency	7.1% (6)	12.9% (11)	48.2% (41)	31.8% (27)	85
Internal environmental quality	3.5% (3)	11.8% (10)	47.1% (40)	37.6% (32)	85
External environmental issues	4.7% (4)	24.7% (21)	48.2% (41)	22.4% (19)	85
answered question					85
skipped question					9




13. Improving resource efficiency and sustainability begins with measuring where you are now. Would an environmental rating tool the measures energy efficiency and other sustainable attributes be useful in your school:

	Yes	No	Maybe	Rating Average	Response Count
Yes/No/Maybe	57.6% (49)	0.0% (0)	42.4% (36)	1.85	85
				Comments	15
	answered question				85
	skipped question				9






14. When would you prefer to use an energy and environmental rating tool:

		Response Percent	Response Count
Anytime		49.4%	42
As part of the 10YP condition assessment		47.1%	40
Not at all		3.5%	3
	answered question		85
	skipped question		9








15. Would an energy and environmental rating tool that could be used by you as a management tool, by teachers and students as a learning tool, and by your project manager be useful?

		Response Percent	Response Count
Yes		69.4%	59
No		1.2%	1
Maybe		29.4%	25
	answered question		85
	skipped question		9












16. If you wanted more information on sustainable learning environments, where would you look first?

		Response Percent	Response Count
Ministry web site		34.1%	29
Other web sites		32.9%	28
Library		2.4%	2
Project manager		20.0%	17
Other (please specify)		10.6%	9
answered question			85
skipped question			9

17. How would you prefer to receive information on sustainable learning environments?

		Response Percent	Response Count
Hard copy booklet		20.0%	17
On line content		31.8%	27
Seminar/training		10.6%	9
Monthly mail outs/news letters		3.5%	3
Network News		8.2%	7
Email		21.2%	18
Other (please specify)		4.7%	4
answered question			85
skipped question			9

18. What sustainable learning environment topics would you like to know more about, if any (you can choose more than one)?

		Response Percent	Response Count
Energy efficiency		76.2%	64
Water efficient		53.6%	45
Waste reduction		56.0%	47
Indoor environmental quality		72.6%	61
Sustainable transport		15.5%	13
Hardwood alternatives		17.9%	15
Low toxicity building materials, paints etc		45.2%	38
Embodied energy in building materials		41.7%	35
Sustainable heating alternatives		69.0%	58
What others are doing in this area		58.3%	49
Other (please specify)		6.0%	5
answered question			84
skipped question			10